AUTOMOTIVE INDUSTRIES

LAND — AIR — WATER

AUGUST 15, 1940

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The AUTOMOBILE

Reg. U. S. Pat. Off.
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CONTENTS

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IN THIS ISSUE....

AUTOMOTIVE INDUSTRIES
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Volume 83 August 15, 1940 Number 4

The Big Four? Production and conveyor lines measuring 14 miles are being completed at Kenosha, Wis., as Nash motors rushes to completion an expansion and remodeling program calling for about $7,000,000 in preparation for its entrance into the low-priced automobile field in the fall with what is said to be a completely new kind of automobile.

Although the new car has been kept well under cover during the three years that it has been engineered and road-tested, rumors concerning it began to leak out some time ago. George W. Mason, president of Nash-Kelvinator Corp., in a recent announcement stated officially for the first time that Nash is readying such a car for sale in the Ford, Chevrolet and Plymouth mass automobile markets.

Details of the car were not revealed by Mr. Mason, who said that it probably would be formally announced in early October along with the Nash motors other 1941 models. He did make known that it is not a small car, but a large automobile with full three-passenger seats. New construction principles and new manufacturing methods will lower the cost of manufacturing the car and make it possible for Nash to place it in the lowest-price market, he explained.

Most of the production lines in the Kenosha Nash plant were either reconstructed or revised, and equipped with new machines, several of which will be exclusive with Nash, in the expansion and retooling program. New additions have been made to the manufacturing plants at Kenosha and many changes are being made in the assembly and conveyor lines in the big Milwaukee, Wis., body making plant.

A program for expansion of the Nash distribution organization was started several weeks ago when W. A. Blees, general sales manager, and members of his staff made a tour of leading cities of the U. S.

Since 1913 all issues of AUTOMOTIVE INDUSTRIES have been indexed in the *Industrial Arts Index*, which can be consulted in any public library.

AUTOMOTIVE INDUSTRIES

Published on the 1st and 15th of the month

Vol. 83, No. 4
August 15, 1940

More Trained Men-

By George T. Trundle, Jr.*

To speed our defense program the nation needs more trained men.

There is no question about the shortage. It is here, and it is real. Ask any machine shop.

We have millions of unemployed—but they don't know how to operate machines. What's to be done?

First, let's analyze the need. What do we mean by "trained" men? How much training is required?

It takes years—four years of apprenticeship and many more of varied experience—to make a really skilled mechanic.

That's too long. Let's keep up our apprentice courses, by all means—to build for tomorrow. But today we must move faster.

We can't wait to teach men to do *any* work on *any* machine.

We must teach hundreds of thousands of men today to do *one* job on *one* machine.

That doesn't take years. It doesn't take months. It takes only four to six weeks—if it is done in the right way by the right instructors.

Now we're getting down to the nub of what might prove to be the bottleneck. The highly skilled men in industry are the very ones whom we need for the training of new men. But today our highly skilled men are so busy operating machines that they can't take time off to train new men.

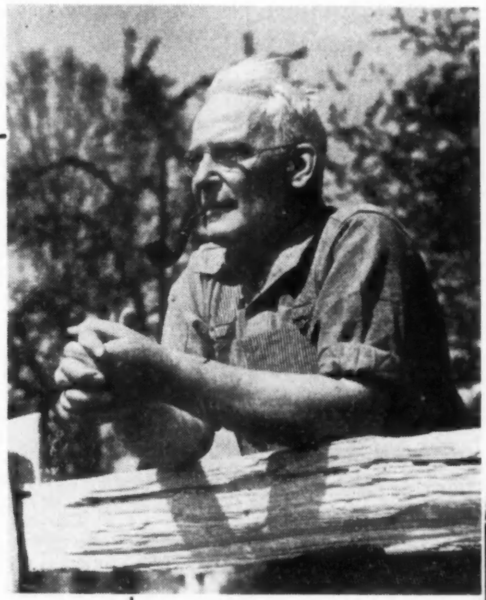
That must be changed. Somehow we must switch more skilled men from operating to teaching. How are we going to do it?

First — many all-round skilled mechanics are now operating automatic or semi-automatic machines which could be run, after a minimum of instruction, by less skilled men. Let's put the newer and younger men to work on these automatic and semi-automatic machines, and thereby free more of the older, highly skilled men for training purposes.

Another method is to combine production and teaching. Suppose a highly skilled man, now operating a certain machine, takes an understudy under his wing. The job of the older man is to teach the younger man how to operate that machine without stopping or interfering with its continuous operation. A single pupil under a skilled tutor can make mighty rapid progress. Within a few weeks the older and skilled operator of that machine can turn the machine over to his young pupil—and immediately go to work teaching exactly the same thing to another younger man.

I have seen this method put into operation and watched it work in a number of plants. I know it works.

Today it is up to the older men, who know how the work must be done, to impart their skill to the younger men who have the stamina to do it. Younger muscles



Now is the time for skilled men who have retired on farms to return to Industry. There are hundreds of them — skilled mechanics — who dropped out of industrial occupations during the depression. The job for these men today is to teach the younger generation.

GENERAL

* President, the Trundle Engineering Co. Director, the Association of Consulting Management Engineers.

combined with older brains can solve this problem of national defense productivity.

Now is the time for skilled men who may have considered themselves "too old" for jobs, and who have retired to farms or set up service stations or hot dog stands, to offer their services once more to American industry as trainers for the younger generation.

There are hundreds of these men—skilled mechanics who dropped out of industrial occupations during the long years of the depression. Today they can and they must make their come-back in industry. Only last week an old shop foreman who had played around on a farm for the last eight years wrote me that he was going back to work in a big city plant. "They need men like me," he said, "to help the boys get started."

It is amazing what a few older skilled men can do with a group of earnest-minded boys who are anxious to learn. Let me tell you this brief story:

A company with which I am familiar started, in a small town, the manufacture of a product which required special skill and experience. There were no men in this whole town who had this skill and experience. The company brought in *two* skilled men. Within 30 days these two men had trained enough boys, fresh off the farm, so that the company could start production—and within nine months the company had 60 men in its plant, none of whom had ever done that type of work before—and turned out a product superior in quality, at a cost far below the average in the industry.

Men can be trained to do the jobs which have to be done. And they can be trained in a hurry. They can be trained right now—if we put to maximum use all of the excellent training skill which we possess in these United States.

But men can't be trained for national defense jobs in classrooms. They can't be trained with blackboards and textbooks. Theory is no substitute for practice.

Some people seem to have the idea that we can set up in this country broad, general schools in which thousands of young men can be taught almost overnight to operate almost any kind of machine. This is nonsense.

The only way that men can be taught how to run machines is by actually putting them to work at those machines on the floors of the industrial plants of this country.

There is one exception. Thousands of boys are taking technical courses in our high schools. If the industries of each city would supply these schools with machines and materials, the boys in these classes might get at least a start toward the practical production experience needed for going to work in their own communities.

And, of course, an intelligent defense program demands not only maximum utilization of skilled men for training purposes—it demands likewise an intelligent utilization of all of our existing production facilities.

The general assumption seems to be today that we cannot even start on any broad-gage defense production program until the machinery manufacturers of this country have turned out vast quantities of new machines.

This is a false assumption. It does not take into account the hundreds of thousands of machines now standing idle in the plants of this country—machines which are immediately available for defense production, and which could be put to work tomorrow.

Many of these machines are old—but they may be perfectly good for single-purpose production of the type required by national defense. Others, in need of repair, could easily be rebuilt.

Every old machine now standing idle which can be put to work for defense production purposes would help relieve today's tremendous burden upon the builders of new machines. It would make it possible to direct new machines into the particular channels for which they are especially needed — permitting old and rebuilt machines to take up the marginal burden and thereby speed up the whole national defense production program.

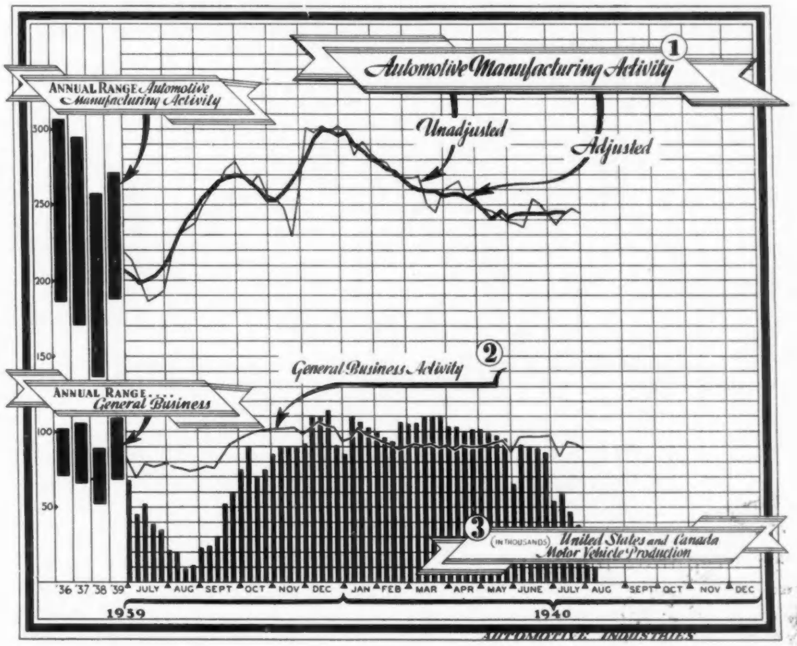
As I see it, this job of national defense is primarily a job of coordination. I believe we have in this country the man-power and the machine - power needed to do the job right now. The challenge before us today is one of organization and utilization.

The Brass-Hat Rack

"Miss Hobson, do we still take two per cent off for cash when they sue us for payment?"

BUSINESS IN BRIEF

Our own view of automotive production and sales; authoritative interpretation of general conditions



Weekly indexes of automotive general business charted

Changeover Curtails Car Production

PRODUCTION in the automotive industry was confined chiefly to trucks and commercial vehicles during the first half of August. The only passenger car manufacturers in production were Pontiac, Hudson, Packard and Graham, all building 1941 models. The other plants were completing their changeover operations and most of them were expected to be in production on 1941 motorcars by the latter part of the month. Subassemblies were underway in most plants and a few pilot cars were coming off the line by the middle of the month.

For the week ending Aug. 10, production was estimated at 12,200 units. This was expected to rise slightly to 15,000 vehicles for the week ending Aug. 17. Production will have to be greatly accelerated in the last half of the month to exceed the output of August, 1939 when the total was 103,343, vehicles, lowest for any month last year. Production in July totaled 237,300 units, according to the estimate of the AMA. Retail sales in July continued to show noteworthy gains over the same month of 1939. Some sales executives even predicted a shortage of used cars due to the increase in buying power in certain areas stimulated by the national defense program. The booming aircraft industry on the Pacific Coast has boosted sales totals in that region. June new car registrations in California totaled 25,495 vehicles, the second highest June on record.

Preliminary reports from 113 cities by R. L. Polk & Co. indicate that new passenger car registrations for July will be approximately 40 per cent greater than July, 1939. Based on these reports, July passenger car registrations are estimated at 320,000 vehicles compared to 229,308 last year. New passenger car registrations for the first six months of 1940 were 1,814,814 units, according to Polk figures, a gain of 29 per cent over the 1,409,102 units registered in the first six months of 1939. Commercial vehicle registrations for the first six months were 291,118 trucks, up 17 per cent over 1939.

Truck production will doubtless be boosted for the next 18 months by orders for 34,000 light and heavy trucks by the National Defense Commission in line with the U. S. Army Mechanization Program.

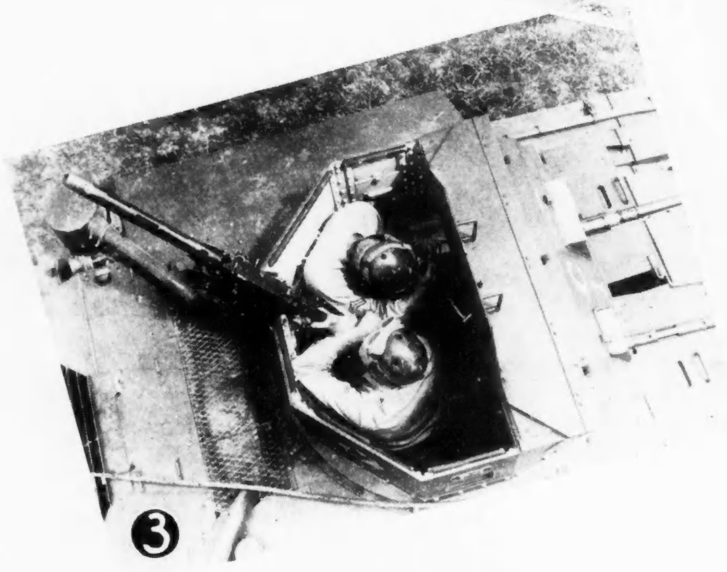
Retail sales of 90,294 Ford cars and trucks and Mercury cars in the U. S. during July gave dealers the largest month of the model year with the exception of March. The July total was the best for that month since 1937. Commercial car and truck sales for the month not only exceeded every July since the introduction of the V-8 but topped every July total as far back as 1930.

Lincoln Zephyr sales were the highest for any July in the history of the car, and were the best for any month since June, 1937.

Automotive manufacturing activity fluctuated very little in the weeks ended July 26 and Aug. 3 from the pace maintained during the preceding month, the unadjusted index moving through 248 and 245, respectively. The adjusted index curve plotted herewith shows more clearly how the manufacturing rate has leveled off with figures of 246 and 245 being marked up for the weeks ended July 13 and July 20.

[1] 1923 average = 100; [2] Prepared by Administrative and Research Corp. New York. 1926 = 100; [3] Estimated at the Detroit office of AUTOMOTIVE INDUSTRIES.

Mechanized



Preparedness

In line with the speed-up program of rearmament for the navy, army and air forces, one of the first and most important steps to be taken, according to army spokesmen, is the mechanization of at least a dozen divisions.

The Seventh Cavalry Brigade, at present Uncle Sam's only mechanized brigade, is a highly mobile unit possessing fire power and striking force. A second brigade is to be formed and then many others will follow.

1. Tanks of the Seventh Cavalry Brigade at Fort Knox, Kentucky.

2. The occupants of a machine-gun car leap out and run forward to build up the firing line as the occupants of another car prepare to fire on a plane.

3. Looking directly down into a tank as the commander mans the .30 caliber anti-aircraft gun. Behind the commander and facing forward one above the other, are two .30 caliber guns. For full firepower ahead, the commander takes the upper gun and the assistant driver takes the lower.

4. In this view a tank is taking a low, thick concrete rampart.

5. The command car of a reconnaissance troop. Here as shown the captain has received a message by runner while the operator of the two-way radio jots down another. The transmitter key is strapped to the operators left knee.

6. Tank cab into which four troopers must crowd. Just above the drivers head is a .50 caliber gun and to the right a .30 caliber.

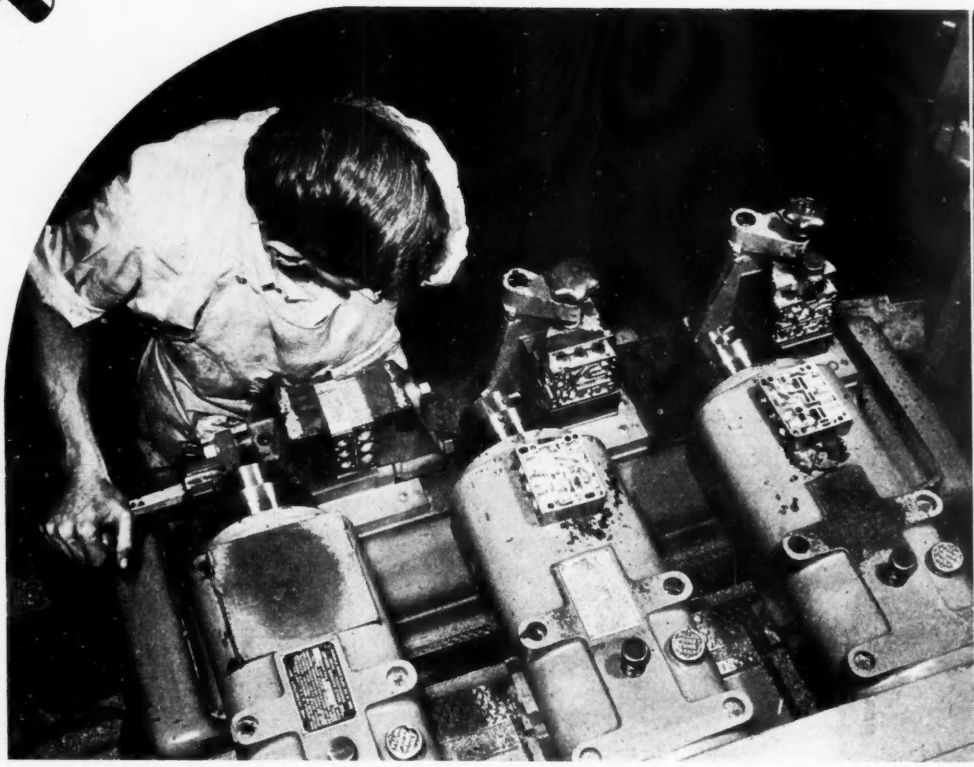
7. As the cycle hits the ground the rider takes to cover.

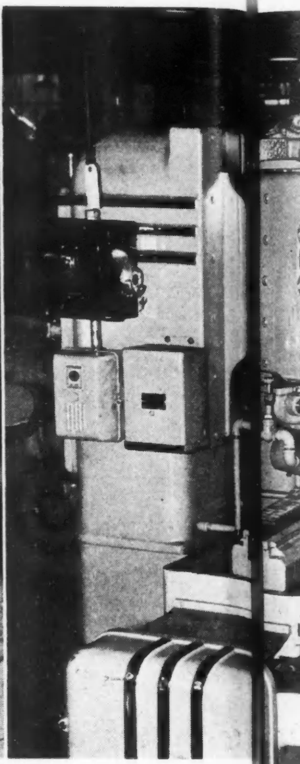
8. A tommygun, instead of a carbine, hangs in the gun boot at the right hand of the new day cavalryman.

9. On six trucks is packed the equipment necessary for getting tanks across a stream. The girders come in six-foot sections that can be quickly bolted together and hauled into place.

10. If necessary the 81 millimeter mortar can be fired from its carrier as is being done in the illustration. The range is 2200 yards.

New Processes Adapted to Mass Production





By Joseph Geschelin

If there are any doubts as to the ability of impressing mass production methods on a highly technical mechanism such as the Olds Hydra-Matic transmission, they can be quickly dispelled by a visit to the Detroit Transmission Division of General Motors Corp., where this unit is built. Here in a setting provided by a productive floor space of 148,000 sq. ft., will be found some of the most advanced metal cutting procedures known.

In the background is a masterly sketching of production process interwoven with precision in every detail. In fact, the framework of the entire scheme rests on three basic principles: precision boring—precision facing—precision indexing.

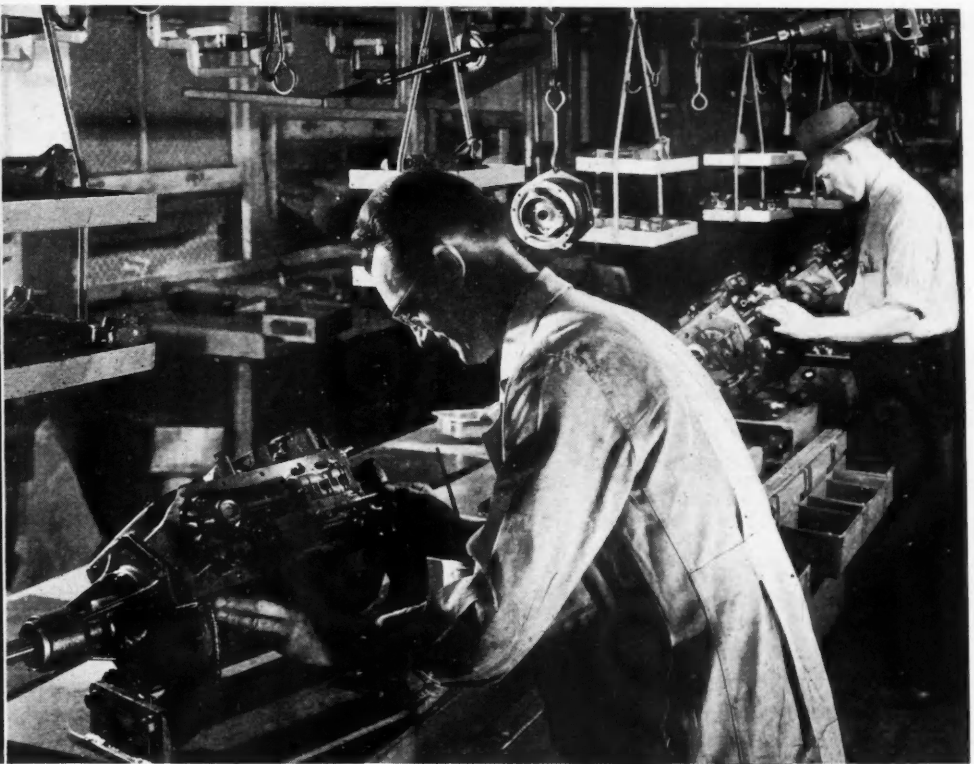
For the student of production management, it will be of interest to compare the present set-up with that of the first edition of the Olds self-shifting transmission, built in Flint, and described in Automotive Industries, Sept. 11, 1937. The present facilities reflect not only the basic differences in engineering design but also intimate the availability of new processes introduced in the interim.

One fundamental change, for example, is found in the making of gears. In the present set-up, the gears are hobbed or shaped, depending upon design, shaved in the green, then heat treated in furnaces having controlled atmosphere. Lapping after heat treatment no longer is employed. Fire distortion of relatively intricate forms such as internal gears is prevented by quenching in Gleason machines.

The successful application of precision methods implies the use of instrumentation to assure conformity with established standards. So far as gears are concerned, this is achieved through the operation of a fine gear laboratory which is ventilated and maintained at a temperature of 72 deg. Fahr. Unusual feature of the lab is a Profilograph which is employed in the exploration of precision-finished surfaces. Another aspect of quality control is the use of GMR vertical balancing machines for the production balancing of many basic elements such as the flywheel, torus sections of the hydraulic coupling, and large rotating parts. Generally speaking, each of the balanced parts is held within $\frac{1}{4}$ oz. in.

A quick inventory of equipment installed in this plant reveals many familiar names, expressed as spe-

# of Olds Transmissions



(Above left) Close-up of a three-spindle Heald precision boring machine tooled for precision-facing valve bodies.

(Above) New Michigan Tool Type 900 rack shaver in the gear department supplements a battery of the earlier models of these rack shavers.

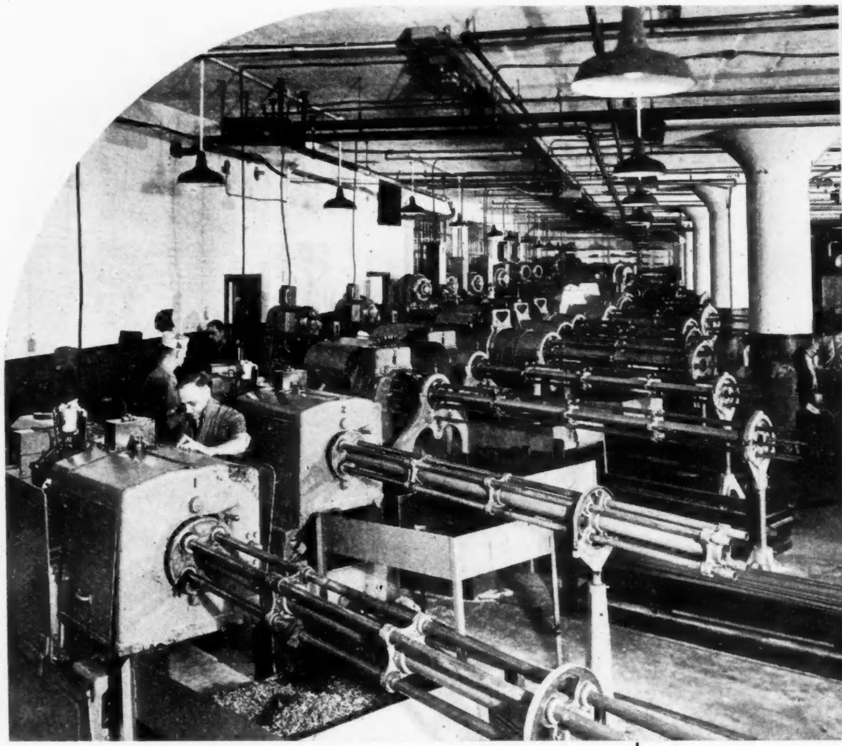
(Above right) Intimate view of several stations on the final assembly line. The overhead feeder conveyor which carries component parts to this line may be seen in the center.

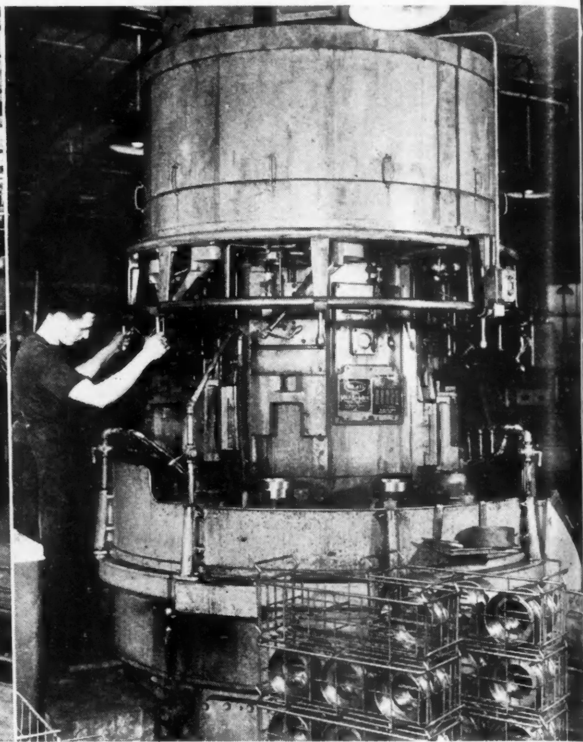
(Right) One of the Type A Barber-Colman hobbing machines hobbing twelve flywheel rings at a time.

cial combinations of unit-type machines or standard machines with special fixtures and tooling. Prominent among these are the following: special Greenlee way machines, Natco way machines, W. F. & John Barnes equipment, Fay lathes, Sundstrand lathes, many Imp lathes, a unique Ingersoll multi-head machine, a number of the huge Conomatics, Foot-Burt drilling machines, Blanchard grinders, etc.

A majority of the parts lend themselves to chucking operations and most of these are handled on 6- and

PRODUCTION





8-spindle National Acme Gridley automatics. However, the large pieces such as drums are tooled on the big Bullard Mult-Au-Matics. Both types of equipment employ double-indexing wherever expedient.

For a quick perspective of plant activity, we shall touch upon the details of some of the major departments, and in a later section will describe some of the major items of equipment. Briefly the departmental set-up is as follows:

Fluid Coupling

In one corner of the second floor will be found a compact department housing the machining and assembly of the hydraulic unit. The large stampings, segments, and machined parts come in from the press shop and machine shop respectively. The stamped housings are machined to size and slotted, then are fitted with hubs and segments, the latter being permanently fixed by turning over a series of keys in one sweep in a special fixture. Each section then is balanced in a GMR vertical balancing machine, correcting out-of-balance by spot welding a small metal slug.

Press Shop

This is located on the main floor, produces the stampings for the fluid coupling, flywheel housing, flywheel, flywheel ring gear, etc. Prominent equipment here is the familiar No. 675 Bliss press with automatic feed for making all blanks. It is fitted with an ingenious circular slack adjustment for feeding the strip to the roller leveler attachment. The other end of the press bed has a scrap shear for digesting the trimmings.

Another impressive machine is the Bliss Hydro-Dynamic press of 1000-ton capacity used for restrike operations on all heavy stampings such as the flywheel, flywheel housing, torus shell, and torus ring. Two No. 59 Toledo presses handle the general run of forming operations.

Flywheel production is handled in its entirety in another section of the press shop, major equipment comprising two Sundstrand lathes and a pair of Gisholt flywheel lathes. The ring gear is formed from heavy bar stock, flame welded at the open joint. The rings then are annealed to relieve strains and while still hot are coined to size on the Hydro-Dynamic press. In this operation the inside diameter is held to plug size while the thickness is coined simultaneously. Gear teeth are cut on a battery of three of the new Type A Barber-Colman hobbing machines, then pointed on a big Cimatool chamfering machine.

Table I
Rear Unit Internal Gear

OPERATION AND EQUIPMENT

Rough and finish **TURN** and **BORE** complete
8-in. Bullard double index, 8-station machine
DRILL and **TAP** all holes
Double end Greenlee drill and tapping, 5-station machine
GRIND 6.497 outside diameter
No. 1 Cincinnati grinder
Precision **BORE** and face 6.687 in. and **FACE** end
BORE 6.248 in. and **FACE** pressure plate face
Ex-Cell-O double end boring machine
CUT internal **GEAR** teeth
No. 715 Fellows gear shaper
BURR holes
Cincinnati burring head
BALANCE
Balancing machine
WASH
INSPECT

(Left) General view looking down the well equipped automatic department on the second floor, featuring new machines supplied by National Acme, New Britain, and Cone. At the right, out of the field of the camera is the precision machine department for valve and governor bodies.

(Center) One of the eight-spindle, double-index Bullard Mult-Au-Matics, tooled for rear unit internal gear blanks.

Balancing the fluid coupling cover to ¼ ounce-inch on one of the GMR vertical balancing machines in the fluid flywheel department on the second floor.

Automatics

A small but outstandingly modern automatic screw machine department, equipped with big machines exclusively, is found on the second floor, producing blanks and transmission shafts for the second operation Acme-Gridleys and Conomatics on the main floor. The equipment comprises—two New Britain-Gridleys, ten National Acme-Gridleys and two of the latest 6-spindle Conomatics which weigh around 20 tons apiece.

Control Valves

Much of the real precision work is concentrated in this second floor department, including also the preparation of the hydraulic governor, and assembly of the control valves. It is replete with special multiple head Kingsbury drilling machines, Ex-Cell-O precision boring machines, and Heald precision boring and precision facing machines. An example of the activity is found in the routing of the inner valve body, reproduced elsewhere.

The routing brings out the interesting point that the precision-faced joint faces are lapped by hand to assure oil-tightness without the use of gaskets anywhere in the pressure system.

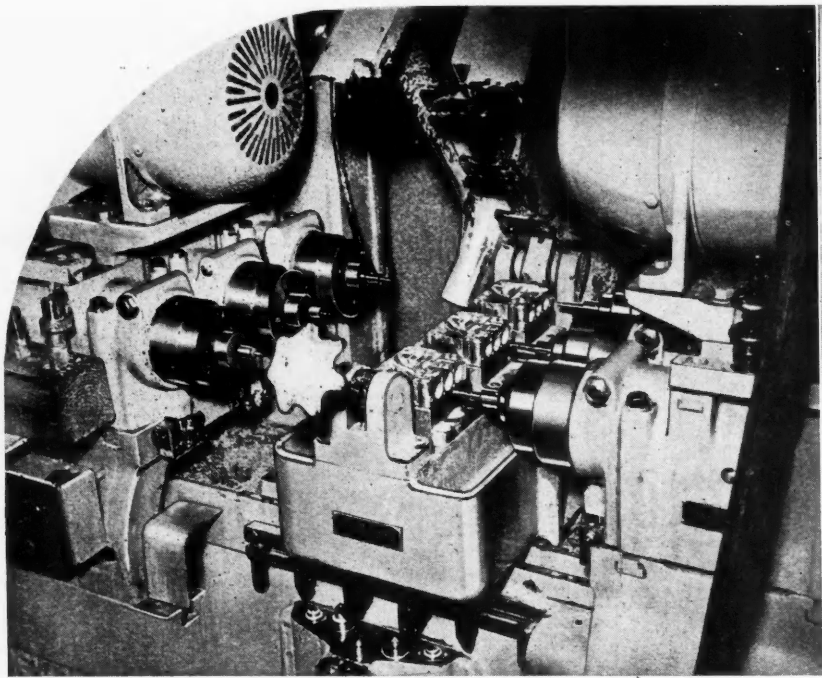
Brake Bands

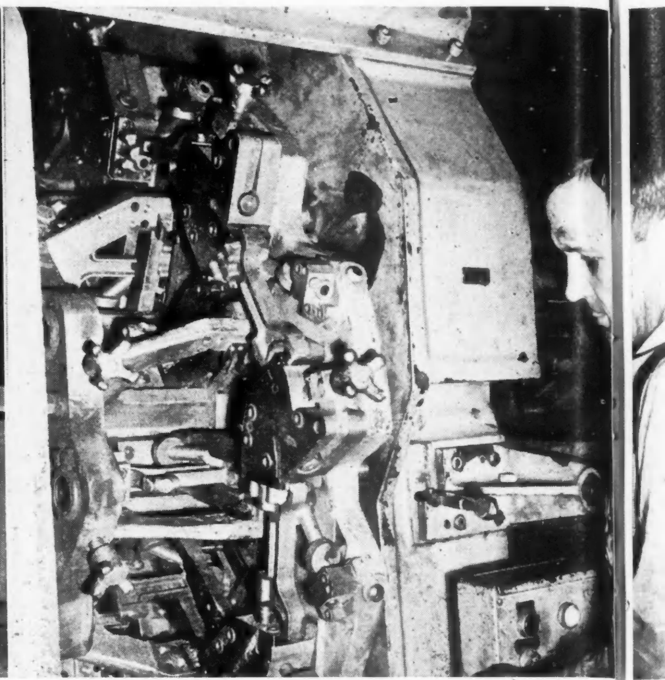
The main floor has a small but very busy department devoted to the production of the brake bands. Generally speaking, the machined parts are coined on a large press, finished on a battery of Kingsbury multiple-head drilling machines. A number of the conventional machines for riveting the lining to the band.

Table 2
Transmission Driven Shaft

OPERATION AND EQUIPMENT

CENTER both ends
Seneca Falls centering machine
TURN outside diameter groove and **FACE** flange
Cone automatic 6-spindle machine
DRILL, BORE, REAM step hole. Bore flange end. Face flange thrust face. Face and chamfer center
Cone automatic 8-spindle machine
DRILL (1) 0.2344 in. hole and (2) 0.125 in. holes
Fosdick drill press
Leland-Gifford drill press
DRILL (1) 0.125 in. hole. Bell end. Remove burr
Avey drill press
Hand tool
MILL 3 slots for gears
Cincinnati Mill
HOB 16 splines
Cleveland single spindle hobbers
Spot **GRIND** for indicating for straightening
Landis grinder
HEAT TREAT—cyanide and quench
Ajax cyanide furnace
WASH
Niagara washer
DRAW—anneal one end
Homo furnace
WASH
Niagara washer
CLEAN centers
Leland-Gifford drill press
STRAIGHTEN
Hydraulic Oil Gear press Type "P6"
HOB 12 splines
Cleveland single spindle hobbers
GRIND 1.1685-1.690 diameter
Landis grinder 10 x 18 in.
Grind 1.372-1.373 and 1.181-1.1813 in. diameters
Face shoulder 0.186-0.189 in.
Landis grinder 10 x 18 in.
Grind 1.1705-1.1710 in. diameters
Norton grinder 6 x 18 in.
Grind inside face 0.186-0.189 in.
Heald internal grinder
Drill 3 holes flange
Cincinnati 24 in. drill press
Ream 3 holes flange
Cincinnati 21 in. drill press
Inspect





Gear Laboratory

This is the heart of the control of gear manufacture. In addition to checking cuttings tools and initial set-up of machines, the laboratory carries on a sampling check of production gears, taking ten gears in the green and ten after heat treatment, of each type, during the course of each day.

Among the items of equipment are two Illinois Gear-Charters which record the tooth profile against a master gear, nine other Illinois instruments for checking helix, spacing, and tooth form.

In addition, there is a Profilometer for measuring the quality of surface finish on precision-faced parts. Sampling checks are made on planet pinion pins which are held to four micro-inches; on intermediate shafts and the rear unit drum bearing race, held to six micro-inches.

Gear Production

Typical routing for small gears is that of the oil pump gear reproduced elsewhere. In general, gears are hobbed on single-spindle or eight-spindle Cleveland hobbers. However, a large group of Fellows High-Speed gear shapers is employed for cutting all internal gears and such external gears as have interfering shoulders. All gears are shaved in the green using Red Ring circular cutter shavers for internal gears, and Michigan Tool rack shavers for the other gears.

Among the Michigan Tool shavers is the new No. 900 machine which is hydraulically operated, smartly styled. It is extremely rugged and rigid in design, providing smooth operation and unusual accuracy.

The routing for one of the internal gears provides a good perspective of the general run of operations.

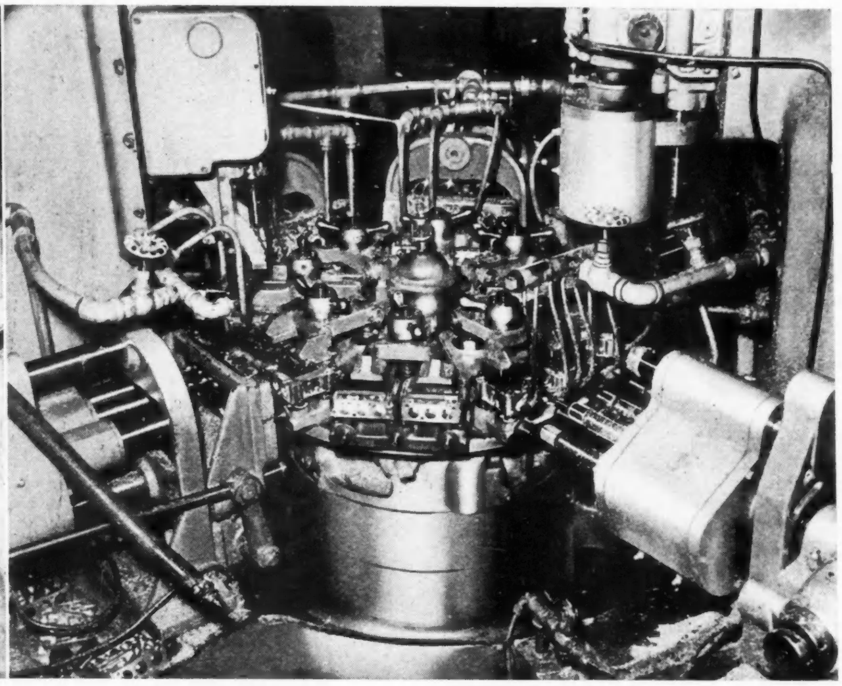
Table 3
Transmission Case

OPERATION AND EQUIPMENT

INSPECT purchased casting
Rough and finish **MILL** bottom and left side
  4-spindle Ingersoll drum type milling machine
DRILL 4 holes and **REAM** same
  Natco 2-way drilling machine
Rough and finish **MILL** both ends
  4-spindle Ingersoll drum type milling machine
MILL bearing cap seat
  24 in. wide Bed Cincinnati milling machine
DRILL and **TAP** all holes **REAM** and spotface
  Ingersoll Multihead processing machine
ASSEMBLE bearing cap to case with 2 dummy plain washers and 2 cap screws to center bearing
  Bench and Hi-Cycle tool
Rough and **SEMI-FINISH** 5.187 in. hole; **COUNTERBORE** 5.380 in. hole; rough and **SEMI-FINISH** 6.750 in. hole; rough and **SEMI-FINISH** 1.874 hole; **FACE** 2⅝ in. diameter on center bearing cap and seat, both sides; **CHAMFER** both sides of 1.874 in. hole; **DRILL** (2) 0.5312 in. holes and (2) 0.4218 in. holes, in front end of case; **DRILL** (1) ¼ in. diameter x ½ in. deep oil hole in Sec. CC
  Ingersoll special 2-way drilling and boring machine
CHAMFER all holes
  Hi-Cycle tool
Precision **FACE** valve body pad and rear pump pad
  Ex-Cell-O 2-spindle 2-position machine
FINISH BORE 5.187 in. diameter, 6.750 in. diameter, 1.874 in. diameter holes, and **TAP** (2) ½ in. x 13 thread holes in front end.
  Ingersoll Special 2-way boring machine
BURR complete
  Bench stand and Hi-Cycle Motor ACKR
WASH
INSPECT

Grinding Department

Wherever expedient, parts are routed to a self-contained grinding department equipped with modern grinders including—Heald Gagematic, Sizematic, and rotary grinders, Norton and Landis plain grinders,



(Left) Ex-Cell-O double precision boring machine rough- and finish-boring three governor bodies in one setting.

(Center) This is a view of the work-holding fixture of the huge four-way Natco drilling machine tooled for various detail operations on the oil pump and governor support body.

This photograph is typical of the Kingsbury multiple-head drilling and tapping machines in the valve department.

as well as several Cincinnati centerless machines.

Transmission Assembly

This is linked with the silent room for gear checking and transmission final block testing.

The main assembly line, illustrated elsewhere, is fed sub-assemblies from the sub-assembly lines, the parts being carried in racks on two overhead monorail conveyors. Gears come in from the silent room which clears all gears used in the assembly. The gears are run in sets or pairs, as the case may be, on a battery of eight Red Ring gear speeders.

Sub-assembly stations are located within the assembly department, with separate stations for major assemblies such as the pumps, planet and band sets, etc. Each one of these lines has equipment for proof testing before the unit is sent over to the main assembly line.

The completed transmissions enter the final test room through a heated passage in which the temperature of the entire unit is brought up to the normal operating level. Each unit is installed in a special electric dynamometer, tested under full load and at all operating speeds.

General Machining

For convenience, the other functions of the plant may be grouped under this general heading. Needless to say, the concentrated activity is much too broad to permit of more than a cursory examination in an article of this character. Fortunately, a good impression of the activity may be gained from a number of typical routings reproduced elsewhere. Here, as on the second floor, will be found a profusion of precision boring, facing, and indexing operations performed on Heald and Ex-Cell-O machines. Most of the initial turning operations are handled on National Acme-Gridley automatics, the larger pieces being scheduled on the battery of Bullard Mult-Au-Matics.

An example of high production technique applied to an intricate part is found in the machining of the oil pump and governor support body. It is faced on a Kearney & Trecker Milwaukee mill, one of a large battery in use here, then drilled, reamed, formed, etc., in a single setting on a Natco 4-way machine with a nine-position indexing trunnion fixture. Tapping and finish-drilling of an oil tube hole are done on a Natco 3-way machine. Following this, three bearing bushings are pressed in and various precision-bored holes finished on an Ex-Cell-O two-spindle, double-end boring machine.

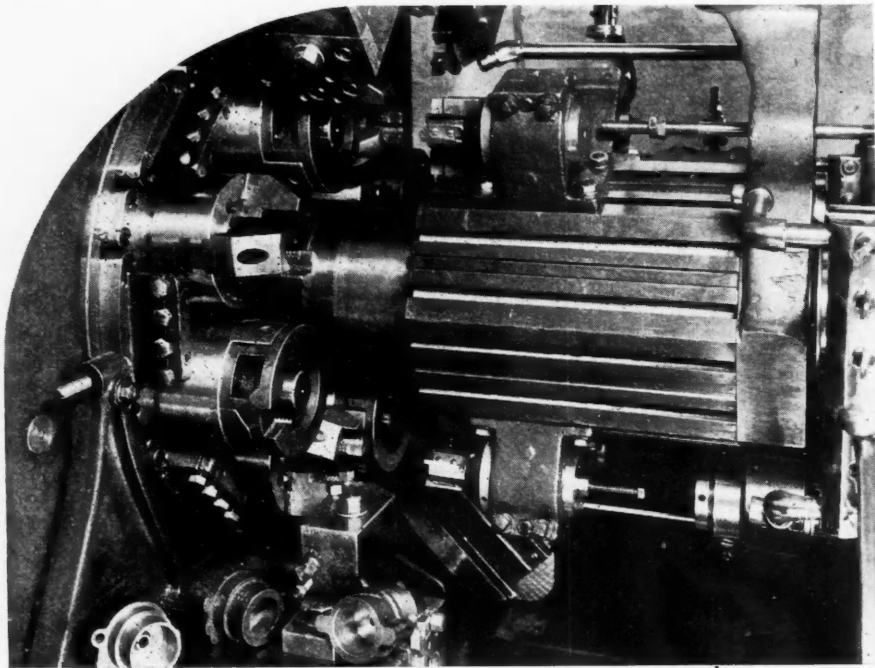
Special Tooling

One of the most important adjuncts of modern production process, particularly where precision boring is involved, is the utilization of special hard cutting tool materials in the interest of maximum productivity and economy. It is quite interesting, therefore, to learn

Table 4
Inner Valve Body

OPERATION AND EQUIPMENT

Receiving **INSPECTION**
REAM 2 locating holes
  4-BM Fosdick drill press with 2-spindle head
FACE top and bottom and 2 ends
  44-A Heald Bore-Matic 3-spindle
TAP (2) No. 10—24 holes in sides
  Hoskins No. 2 tapper
DRILL, REAM and **TAP** 23 holes
  Kingsbury 8-station drilling machine with 16 fixtures
Precision **BORE** 3 valve holes
  Ex-Cell-O 3-spindle double-end precision boring machine
Hand **BURR** all slots and cavities
Wire brush **BURR** both sides and both ends
  No. 3CB Gardner polishing lathe
Hand **LAP** both sides and both ends
  Cast iron lapping plate
WASH in Oleum spirits
BLOW OUT with air
INSPECT



(Left) One of the National Acme-Gridley 6-inch, 8-spindle chucking machines is shown set up for double-index boring, facing, and turning of the rear unit accumulator body. (See table below.)

Table 5
Rear Unit Accumulator Body

(See upper left illustration)

OPERATIONS FRONT SIDE MACHINE	
8th (upper) position	**FINISH** bore, finish turn, finish face flange, finish face end (small end of piece)
1st (upper center) position	**LOAD** rough casting large end out
2nd (lower center) position	**LOAD** semi-finish casting—small end out
3rd (lower) position	Rough **BORE**, spot, rough face (large end of piece)
OPERATIONS OTHER SIDE MACHINE	
4th (lower) position	**CHAMFER** hole, rough **FACE** boss, rough **BORE**, rough **TURN**, rough face end, rough **FACE** flange (small end of piece)
5th (lower center) position	**DRILL** center hole, **CHAMFER** large hole (large end of piece)
6th (upper center) position	**DRILL** two holes in flange (small end of piece)
7th (upper) position	Finish **BORE, FACE** end (large end of piece)

that this plant relies to a great extent upon the well-known materials such as Carboloy, Haynes-Stellite J-Metal, and Haynes-Stellite 2400.

Carboloy tooling is used for most finishing operations on cast iron and close to 50 per cent of steel cutting. Carboloy is employed in turning, boring, facing, and precision boring on all materials; spotfacing, counterboring, reaming, gun drilling, turning, facing, boring—on cast iron, bronze and aluminum. Carboloy is found on Bullard Mult-Au-Matics, Gisholts, Sundstrands, and on the Ingersoll and Davis-Thompson drum type millers.

Among the miscellaneous applications of Carboloy are—Carboloy gages on four Heald Sizematics, Carboloy centers on all equipment in the cylindrical grinding department.

Generally speaking, Haynes-Stellite J-Metal and 2400-Metal are used for machining cast iron and malleable iron, the 2400-Metal also being used for rough- and finish-turning and facing operations on certain steel parts.

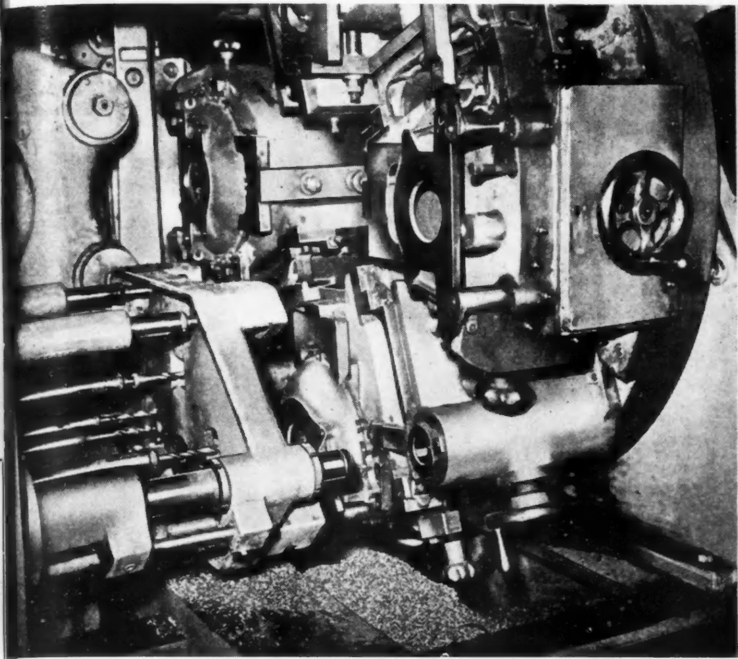
Equipment Notes

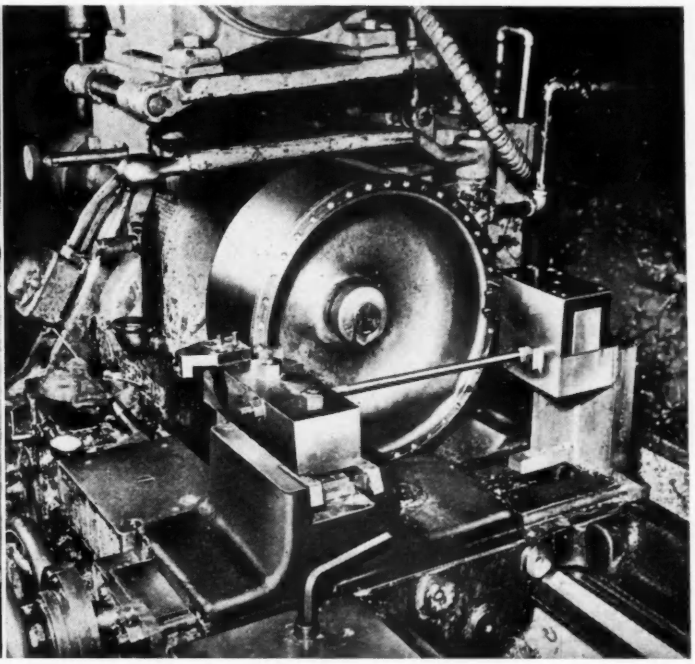
One of the interesting applications of the National Acme-Gridley machines is that of a 6-inch, 8-spindle chucking machine with electrically operated chucks, arranged for double indexing in machining the rear unit accumulator body. In principle, the tooling is so designed that the operations on one side of the work are performed in the odd-numbered positions—3, 5, and 7; then the work is turned around, rechucked and finished in positions 4, 6, and 8. The operations on this part are given in Table 5.

In a sampling of the Natco machines found in this plant, we have selected the newly installed four-way unit for machining the oil pump and governor support body. The machine is of unit-type construction, comprising four Natco Holeunits, and a nine-position automatic indexing trunnion type fixture accommodating two castings in each position. The sequence of operations is given in Table 6.

Several examples of Heald grinding and boring setups are of great interest. Among these is a Heald Bore-Matic, boring three pairs of holes in steel and two bores in bronze bushings in the transmission driven shaft. The shafts are handled in pairs, one mounted in the front station, the other in the rear station. For the latter, the shaft is located from the outside diameter and from the rear flange face, lined up by hand plug and hand clamped. Three pairs of holes are bored in this position. In the front station, the work is supported at the flange end by a split bushing, rotated by a driving unit at the end of the shaft. Two bronze bushings are bored in this station.

Another outstanding boring job is that of boring and chamfering six holes in the rear unit clutch drum, with the requirement that the bore spacing be held within 0.001 in. without cumulative error around the





(Above) Work station of the huge Greenlee two-way drilling machine set-up for drilling, tapping, and boring flywheel cover castings.

(Right) Sundstrand Stub lathe in the flywheel department is tooled for turning recesses in the flywheel cover.

circle. This is accomplished with a special three-spindle boring head which handles the job in two operations. Work is clamped by three straps, held in a rotary fixture, located from a rabbet and one dowel.

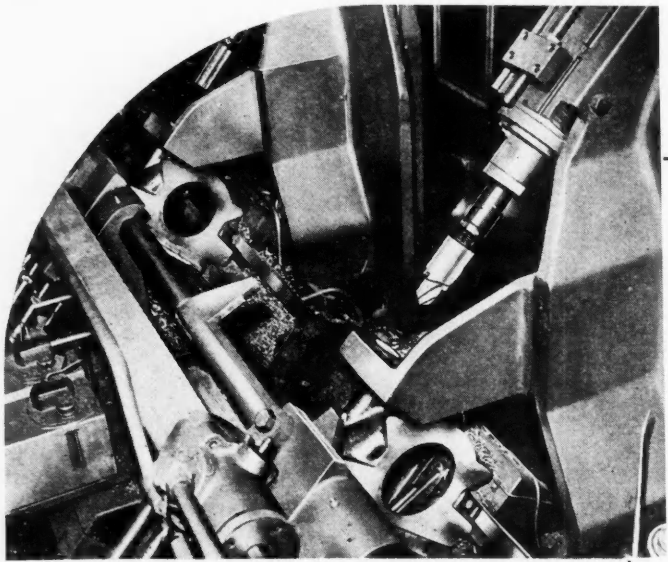
The hydraulic governor body presents an unusual machining task quite like that of a piston, taking three castings in one setting, with three individual tool stations. In operation the table runs in, bores three diameters and faces the outside adjacent face in the middle station; turns outside diameter in the front station. The cross slide then feeds to the front and faces in the rear stations, cuts seven grooves in the front station.

W. F. and John Barnes is represented in the set-up by numerous items of interesting equipment. One example is a large horizontal drilling and tapping machine for the flywheel ring gear. The ring gear, described in an earlier section of this article, is located from one face and the inside diameter, clamped with a quick-acting manually operated mechanism. The machine has a self-contained, hydraulically actuated unit for driving and feeding the multiple spindle head containing 20 combination drilling and chamfering tools. Tapping is performed with a 20-spindle indi-

Table 6—Oil Pump and Governor Support Body

POSITION NO. 1	Remove, relocate and load one part
POSITION NO. 2	Right Hand Head
Location A	**DRILL** 3 holes
Location B	**DRILL** 1 hole
	Left Hand Head
	Idle
POSITION NO. 3	Right Hand Head
Location A	**DRILL** 3 holes
Location B	Idle
	Left Hand Head
Location A	**DRILL** 1 hole
POSITION NO. 4	Right Hand Head
Location A	Semi-finish **REAM** 2 holes
Location B	**DRILL** 1 hole
	Left Hand Head
Location A	Semi-finish **REAM** 1 hole
	Rear Horizontal Head
Location B	**DRILL** 1 hole ½ depth
POSITION NO. 5	Right Hand Head
Location A	**DRILL** 1 hole
Location B	Idle
	Left Hand Head
Location A	Line **REAM** 1 hole through 2 walls

POSITION NO. 6	Right Hand Head
Location A	Rough **COUNTERBORE** one gear pocket
	CHAMFER 2 holes
Location B	Rough **COUNTERBORE** 1 diameter
	Rear Angular Head
Location A	Combination **DRILL** and **COUNTERSINK** 1 hole
	DRILL 2 holes
POSITION NO. 7	Right Hand Head
Location A	Rough **COUNTERBORE** other gear pocket
	CHAMFER 2 holes
Location B	**ROUGH** form 42 deg. angle
POSITION NO. 8	Right Hand Head
Location A	**SEMI-FINISH** 1 gear pocket
Location B	**FINISH** form 42 deg. angle and finish counterbore 1 diameter
POSITION NO. 9	Right Hand Head
Location A	**SEMI-FINISH** other gear pocket
Location B	Idle



One section of the long self-contained Ingersoll Multihead processing machine which completes the multiplicity of drilling and tapping operations on the transmission case.

Table 7
Flywheel Housing Three-Way Machine

STATION 1
Load one flywheel rear housing in position A with bottom presented to head
Load one flywheel rear housing in Position B with transmission face presented to head

STATION 2
Position A — 2 17/32 in. DRILL
Position B — Horizontal Head
7—15/32 in. DRILL
2—27/64 in. diameter DRILL
2—combination 27/64 in. DRILL and 17/32 in. COUNTERSINK
2—combination 17/32 in. DRILL and 9/16 in. COUNTERSINK
1—3.970-3.965 diameter BORE

STATION 3 HORIZONTAL HEAD
Position A — 2—0.875-0.880 diameter COUNTERBORE
Position B — 2—1 1/16 in. diameter SIDE MILL
Position B — REAR ANGULAR HEAD
2—"G" (0.261) DRILL for 5/16 in.—18 TAP

STATION 4 HORIZONTAL HEAD
Position A — Idle
Position B — 4—½ in.—13 TAP
2—0.500-0.501 REAM
Position B — VERTICAL ANGULAR HEAD
2—5/16 in.—18 TAP

vidual lead screw tapping unit in station 2. Station 3 of the three-station trunnion type fixture is for loading and unloading.

One of the interesting items in the transmission case line is a No. 80 Blakeslee washing machine which is used for cleaning the case.

It is of three-tank, pump type, using an alkali solution in the cleaning tank. The first tank is the alkaline wash with hot solution maintained at 180 deg. Fahr. The next two tanks are plain hot water rinses. Each tank is served by a pump individually driven by a 7½ hp. motor, delivering about 400 gallons of solution per minute.

A battery of two Gisholt No. 12 hydraulic automatic lathes is used for turning flywheel rings in preparation for cutting the gear teeth. In the first operation machine, the ring outside diameter is rough- and finish-turned in one setting, chucking six rings at a time, locating from the inside bore. In the second operation machine, the rings are handled one at a time, and the following surfaces finished automatically in one setting—rough- and finish-turn the inside diameter, and large chamfer on outer face with one tool slide; finish outer face with another tool; chamfer inside corner of bore with another tool.

Greenlee is well represented by a group of two-way, three-way and four-way machines. A brief summary of the work performed by two of these machines will serve to provide a typical picture of this interesting equipment. Here, for example, is a three-way horizontal and angular hydraulic feed machine with drilling heads, milling attachment, and individual lead screw tapping head for various operations on the flywheel housing. It is equipped with a four-station indexing drum and two-position fixture, performs the sequence of operations indicated in Table 7.

The second of the Greenlee machines is a four-way horizontal and vertical hydraulic feed machine arranged for drilling, boring, and tapping with an individual lead screw head. It has a four-station indexing drum and performs the operations indicated in Table 8.

Table 8
Flywheel Housing Four-Way Machine

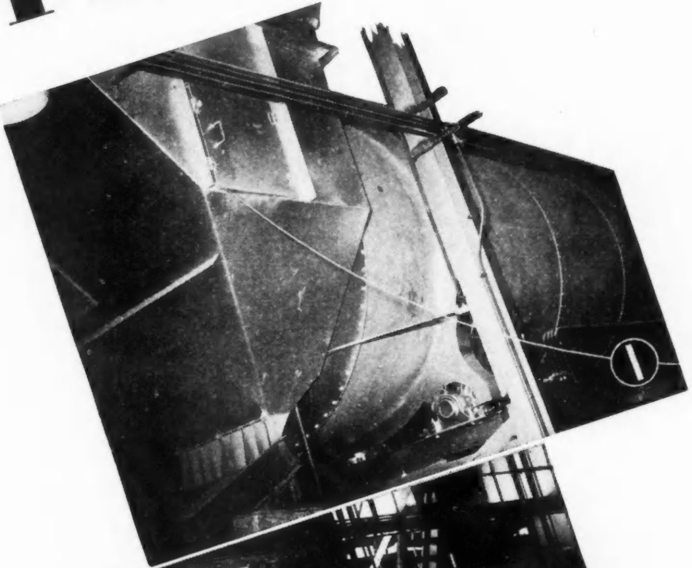
STATION 1 Load one piece

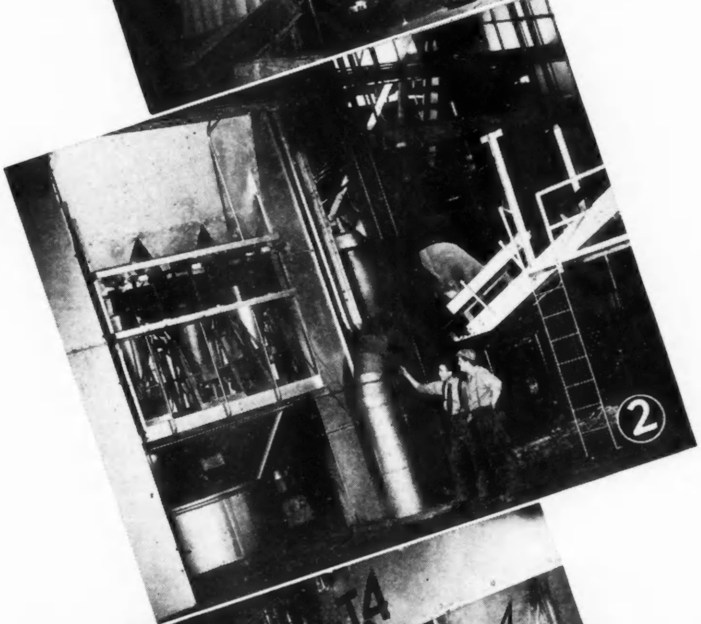
STATION 2 LEFT HAND HEAD
6—"U" (0.368) DRILL for 7/16 in.—14 TAP
4—15/32 in. DRILL
RIGHT HAND HEAD
2—15/32 in. DRILL
5—"U" (0.368) DRILL for 7/16 in.—14 TAP

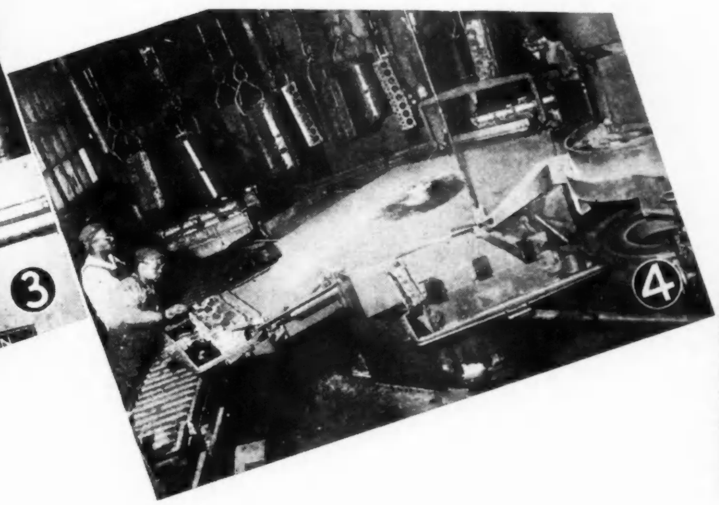
STATION 3 LEFT HAND HEAD
2—CHAMFER for 7/16 in.—14 tap with 9/16 in. DRILL
1—combination rough BORE 3.250 in. and finish bore 3.252-3.250 in. diameter
2—0.500-0.501 REAM
RIGHT HAND HEAD
2—0.498-0.499 REAM
REAR HEAD
3—"G" (0.261) DRILL for 5/16 in.—18 TAP

STATION 4 LEFT HAND HEAD
6—7/16 in.—14 TAP
RIGHT HAND HEAD
5—7/16 in.—14 TAP
VERTICAL TAP HEAD
3—5/16 in.—18 TAP

Pontiac Spends $1,000,000 to Modernize Its Foundry







Last month Pontiac put the finishing touches to the huge million-dollar job of completely modernizing its foundry from railroad siding to installation of a new Gardner automatic grinder for milling the tops and bottoms of engine blocks. Thirty-seven hundred square feet have been added to the foundry proper in addition to a new sand-handling building and output capacity of the entire plant has been boosted from 550 to 785 tons of finished iron a day.

Sand is dumped directly from gondola cars onto grates beneath the tracks of the railroad siding. This arrangement makes it possible to handle 50 tons of sand an hour whereas only 10 tons per hour could be handled with the old method that employed a crane and grab bucket. An apron conveyor moves the sand to a new drier shown in Fig. 1, with a capacity of 400 tons every eight hours. When the sand reaches a bone-dry temperature of 140 deg. it is passed over a screen and goes into storage bins.

Two new 75-ton an hour Simpson "Intensive" sand mixers stir up sand and clay for molding while four new vertical baking ovens bring Pontiac's battery of ovens to 25. One of the new mixers is shown in Fig. 2 while Fig. 3 is a view of the control panel of these machines.

Fig. 4 shows the new Gardner equipment in which blocks pass under and over the grinders on a "merry-go-round" conveyor. The set-up supplants individual swing grinders and raises capacity from 120 to 350 blocks per hour.

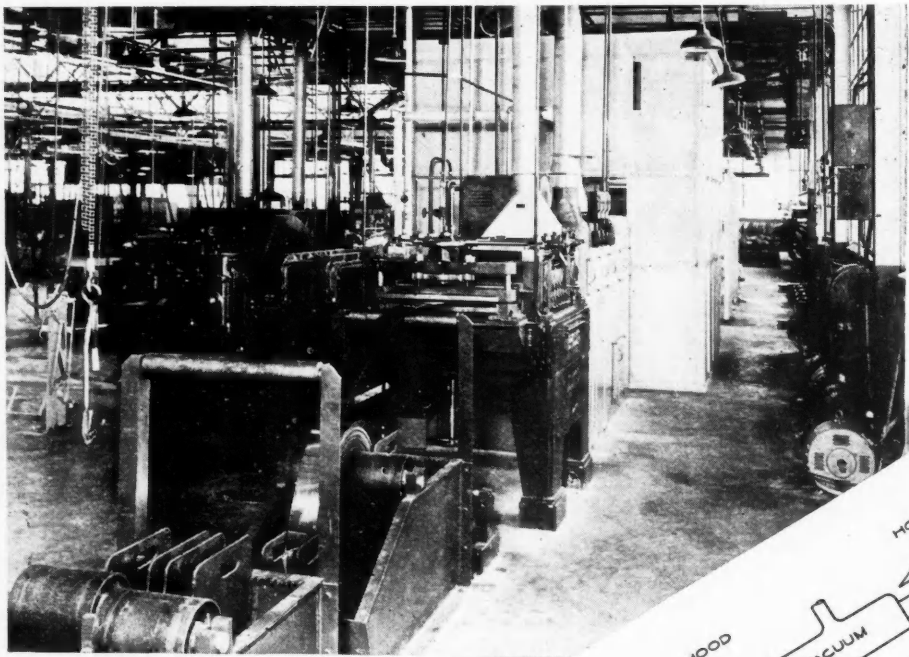


Fig. 1—Steel strip received in reels is made ready for the matrix powder by passing it through a Broden roller leveler machine which appears in the foreground. The large booth in the background is the powder room where the matrix powders are mixed, and then fed onto the surface of the moving strip

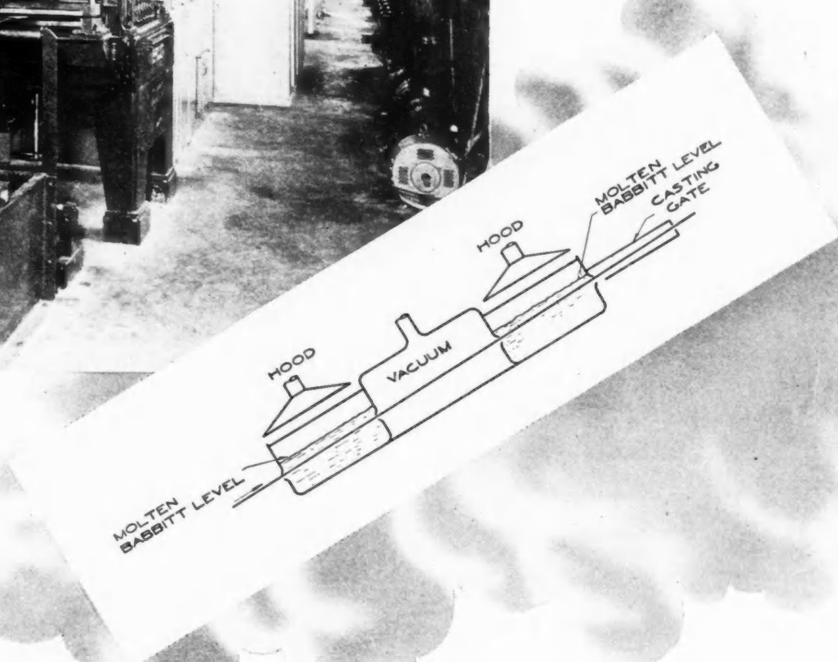


Fig. 2—Sketch showing the three stages of the racuum-tunnel babbitting machine with the thickness sizing station at the extreme right

Steel Back Babbit Bearing

A new steel-back, high-lead babbitt bearing that is expected to increase engine bearing life over 200 per cent has been developed cooperatively by Buick Motors and Moraine Products divisions of General Motors Corp. It will be used exclusively in Buick engines.

In the preliminary stages of this development it was believed essential to meet the following requirements: To provide a porous matrix or foundation which would be bonded firmly to the steel backing, and to provide a corrosion-resistant bearing material which would impregnate the "spongy" matrix, thus developing a permanent bond both metallurgically and mechanically.

Experimental evidence and service history indicated the choice of the high-lead babbitt type as the most suitable alloy because of its resistance to wear and corrosion. It was agreed further that the alloy should be relatively soft to prevent the wearing down of crankshaft journals and pins, thus retaining the original bearing fits.

High grade high-lead babbitt material has been known and used for many years. However, its most useful properties previously could not be realized completely because of a tendency to fatigue failure under the severe conditions of present-day high performance engine operation. Service history showed that fatigue failure, as evidenced by cracking and actual breaking out of portions of the bearing surface, was related to the use of a relatively thick layer of babbitt.

It was found that practically all fatigue cracks were of about the same depth. Fatigue failure begins by the formation of fine radial cracks of fissures in the surface, which grow in depth with time. Eventually, at a certain depth these radial cracks are joined by short circumferential cracks deep in the structure of the metal. When this network of cracks is completed, it results in the loosening of fairly large areas of metal which tear or melt out of the bearing. Further

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Automotive Materials

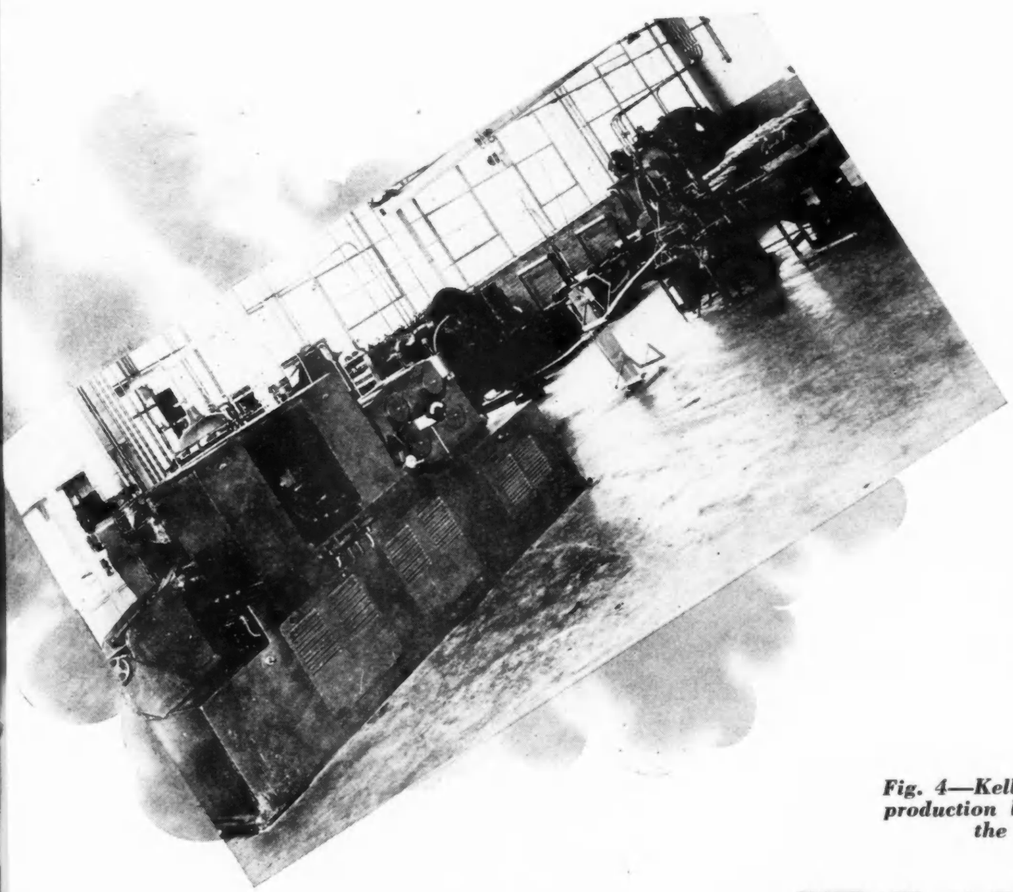


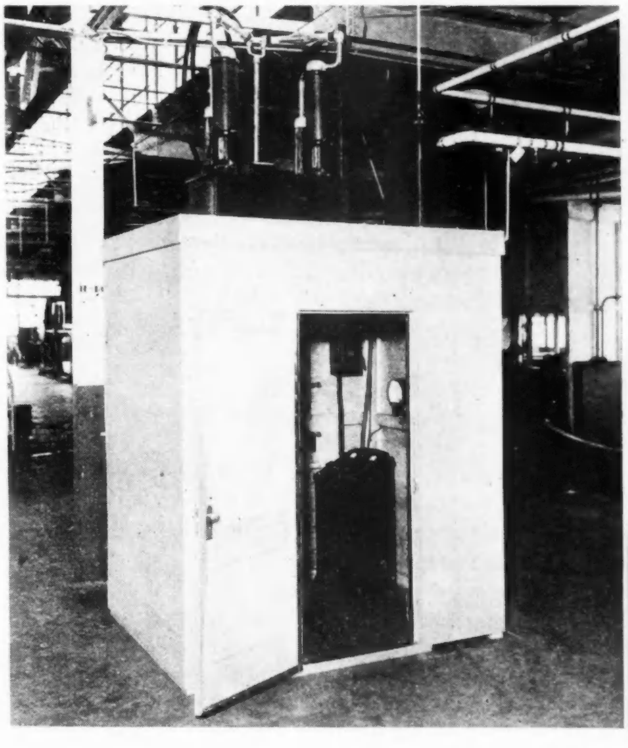
Fig. 3—*At the extreme left is a Cimatool milling machine with conventional down-cut milling cutters in the first stage, climb-cut milling cutters in the second stage, leaving an average of 0.005 in. to 0.010 in. of excess metal for the final finishing operations on the half-shell. At the extreme right is a Minster blanking press which cuts the strip into blanks of the exact size for forming half-shells*

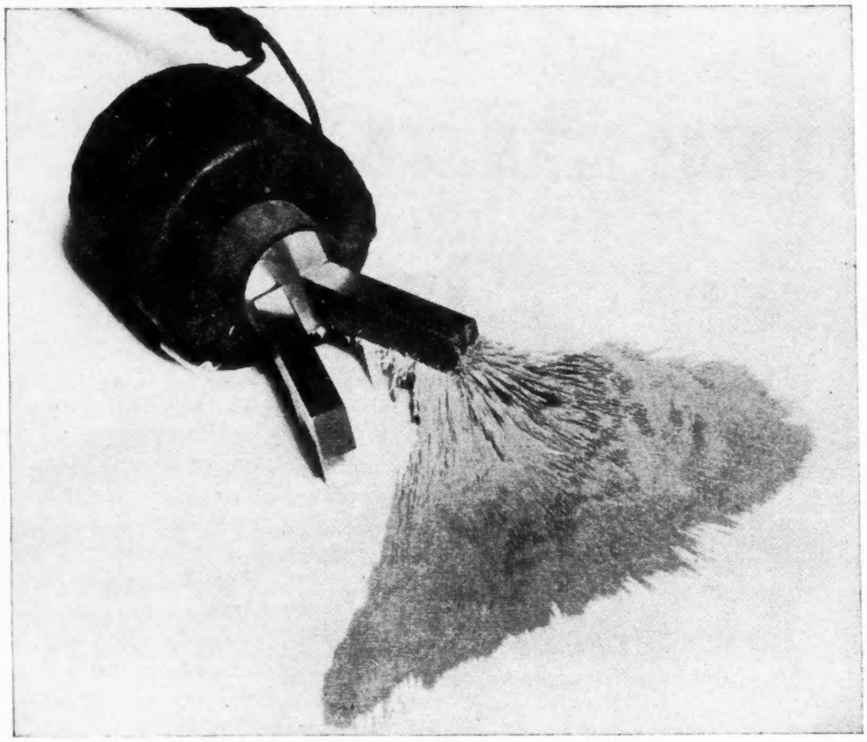
work along this line proved that if an extremely thin layer of bearing material were employed, fatigue cracks no longer developed. Moreover, if radial cracks did develop under certain conditions, there was no opportunity for the development of connecting circumferential cracks without which there could be no tearing out of chunks of bearing metal. It was apparent, however, that an extremely thin layer of babbitt could be used only if means were found for bonding it securely and permanently. A "matrix" serves this purpose in the new bearing.

The matrix for the Buick bearing consists of a mixture of pure powders of copper and nickel in the proportion of 60 per cent copper and 40 per cent nickel. This powder coating is applied to the backing and is then "sintered" by subjecting it to a temperature of 2000 deg. Fahr. in an electric furnace. The powder particles are fused to the steel, becoming a strong sponge-like structure, which the babbitt impregnates while in the molten state. Examination of photomicrographs shows how the babbitt fills all of the pores in the matrix, thus producing not only a chemical bond between the metals but also a secure mechanical attachment due to the interlocking effect of the matrix structure.

The babbitt selected for this bearing contains 92 per cent high-purity lead. In the manufacturing process the thickness of the babbitt above the surface of the matrix is only 0.001 to 0.002 in. In effect, then, the

Fig. 4—Kelley-Koett X-Ray machine used on the production line to provide a sampling check of the structure of bearing blanks





Use of an electromagnet and iron filings demonstrating the non-magnetic characteristics, at the left, as compared with iron piece at the right

posited on it to a measured depth. (See Fig. 1.) After having passed through this machine, the strip enters a four-stage electric furnace where the matrix is bonded to the steel. During a subsequent stage of the manufacturing process, the steel strip with its bonded matrix is passed between a set of large, polished chromium-plated rollers which subject it to pressures as high as 10,000 lb. per sq. in. In this way a pre-loaded structure is obtained which is still porous, however, and is capable of carrying several times the maximum load encountered in engine operation.

When the strips have been straightened again they are welded together to produce a continuous strip, which latter is passed through a vacuum-tunnel-type machine, Fig. 2, where the babbitt is "flowed" on in three separate stages, or chambers. High vacuum maintained in the central chamber exhausts the air from the pores in the matrix, thereby permitting the babbitt to fill the sponge-like structure completely. A mechanism in the final stage of this machine holds the thickness of the babbitt coating to the proper dimension and simultaneously the babbitt is "frozen" into the desired metallurgical structure by rapid chilling with jets of cold water.

The strip continues on to a milling machine in which the total thickness of the strip, as measured from the underside of the steel back to the top surface of the babbitt, is held to desired limits by trimming the soft babbitt with two milling cutters. This process leaves on the babbitt an excess of 0.005 in. to 0.010 in. for the final finishing and mirror-burnishing operations.

Finally, a punch press, Fig. 3, is used to die-cut the strip into rectangular pieces of the proper size for forming into bearing half-shells. Then the blanks are transferred to the machine shop operations for forming, sizing, finishing and inspection.

Among the special attributes claimed for the new bearing, known as Durex No. 100, are the following:

1. Ability to carry higher bearing loads without failure, or to outlast conventional bearings with present loadings.

2. Makes possible further increases in engine output through improved design and utilization of higher octane fuels, i. e., the ability to produce greater performance in smaller, lighter packages.

3. Banishes corrosion and the fear of scoring crank shaft journals and pins because the matrix, even if exposed due to wearing away of bearing alloy, can carry the load without failure until bearing replacements can be made.

A free-machining alloy steel possessing low magnetic

(*Turn to page* 187, *please*)

bearing has, first, a sponge-like matrix which has an affinity for the steel back and becomes a permanent part thereof, and, second, an extremely thin layer of bearing material, securely bonded and interlocked with the matrix.

The new Buick bearing is said to meet completely the requirements for an ideal bearing as outlined over five years ago in a report by A. F. Underwood, head of the mechanical engineering department, General Motors Research Laboratories. These requirements, as outlined by Mr. Underwood, are as follows:

1. Fatigue resistance—to withstand satisfactorily the imposed load at the operating temperature.

2. Mechanical strength—the ability of the bearing to resist extrusion and pounding.

3. Good bonding characteristics.

4. High melting point—the bearing material must have a high melting point so as to retain its mechanical strength under operating conditions.

5. Low friction and non-scoring characteristics—to prevent galling or over-heating.

6. Conformability—ability of a bearing to adjust itself to shaft deflections and deformation under maximum loads.

7. Embedability—ability of the bearing material to absorb dirt and worn off metallic particles, thus preventing such foreign materials from contaminating the pressure lubricating system.

8. High corrosion resistance.

The bearing backs are produced from strip steel received in reels. The strip is straightened by passing it through a roller levelling machine, and it is then fed through equipment in which the matrix powder is de-

Design of High Speed, Two-Stroke Engines

By SCIPIONE TREVES, DSc., Mech. Engr.*

Section Four

The construction of a theoretical diagram is discussed in this section. Previous sections appeared in the immediately preceding issues

LET US suppose that we wish to design a two-stroke, double-piston engine of the type illustrated in the preceding sections, and that the principal dimensions of same have been already settled upon, including the bore *d*, the stroke *c*, the ratio λ of connecting-rod length to stroke, and the compression ratio

$$\rho = \frac{V_h + V_c}{V_c},$$

where V_h and V_c represent, respectively, the piston displacement of one cylinder and the compression space formed between the two pistons in one cylinder when they are the shortest distance apart. On the basis of practical and experimental data available to him, the designer will assign a tentative value to the height of the ports, which depends chiefly on the length of stroke, the speed of rotation of the engine, and the circumferential length of the ports. We will assume that, for the reasons mentioned in Section I, the ports are made to extend all around the bore. We will also assign a tentative value to the angular offset or phase difference ϕ of one crankshaft relative to the other, which will depend on the normal speed of rotation, on which all engine calculations will be based.

After having drawn (in Fig. 7) outlines of the pistons in the positions corresponding to the opening and closing of the ports, for both the inlet and exhaust, and determined—either graphically or analytically—the angles through which the inlet-controlling crank has rotated since top dead center upon arriving at these various positions, the timing functions of the engine may be represented by a fundamental diagram which we will call the timing diagram (Fig. 8). We first draw two radial lines with an angle ϕ between them, equal to the angular offset between the two cranks, and making an angle $\phi/2$ each with the vertical. The one which comes first in the direction of rotation represents the dead-center line for that end of the cylinder in which the exhaust ports are located; the other, the dead-center line for the other end of the cylinder, which contains the inlet ports. The total exhaust and inlet angles, which have been determined previously, may now be laid off symmetrically to both sides of these axes. From this diagram we may read off the angle

$$\gamma = \Theta - \theta'$$

by which the opening of the inlet port lags behind the opening of the exhaust port, and also the angle δ' by which the closing of the inlet port lags behind the closing of the exhaust port.

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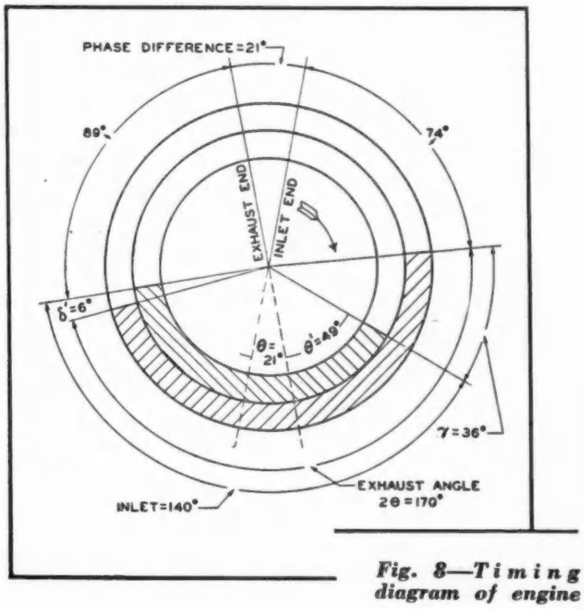


Fig. 8—Timing diagram of engine

ing of the exhaust port. The timing diagram thus drawn gives the designer a clear conception of the engine cycle.

From the timing diagram it is possible to determine the port capacity of the exhaust ports. To this end it is sufficient to plot, as in Fig. 9, crank angles corresponding to the whole of the exhaust period ($2\ \Theta$) as ordinates on the vertical scale, and heights (or widths) of port uncovered by the piston at any particular crank angle, as abscissas on the horizontal scale. Integrating the diagram so obtained with a fixed polar distance p, we obtain a new diagram, the coordinates of which represent the port capacities corresponding to the respective crank angles. The scale of the diagram is given by the scale of ordinates, that is, the product of the uncovered height of port by the polar distance by the circumferential length of the ports. This diagram gives the total port capacity E, represented by the maximum ordinate, and also the value of the port capacity e' corresponding to the angle Θ' at which the inlet ports open. Both of the values thus obtained may be checked by means of the analytical method described in Section III.

The dimensions inscribed on Fig. 9 have reference to a six-cylinder racing engine of approximately 91.5 cu. in., a displacement often called for by international racing rules.

The basic dimensions of this engine are identical with those of the experimental engine mentioned in Section I. The bore and stroke are

$$d = 2.05 \text{ in.} \qquad c = 2.30 \text{ in.}$$

which gives a total piston displacement of 91.0977 cu. in. and a displacement for the individual cylinder of

$$V_h = 15.18 \text{ cu. in.}$$

The length of the connecting rod has been set at 4.53 in., the shortest length compatible with the general design being chosen in order to reduce the weight as much as possible. We then have

$$\lambda = \frac{L}{c} = \frac{4.53}{2.30} = 1.97$$

The compression ratio ρ is 6.5, which is that usually employed in four-stroke racing engines. We have, therefore,

$$Vc = \frac{V_h}{\rho - 1} = 2.76 \text{ cu. in.}$$

As to the total height of the ports in the direction of the cylinder axis, in view of the very high speed at which the engine is to be operated, viz., 6000 to 7000 r.p.m., it is considered advisable to devote 39 per cent of the piston stroke to the exhaust period and 29 per cent of the stroke of the other piston to the inlet period. The total height of the ports is, therefore, 0.906 in. for the exhaust and 0.67 in. for the inlet ports. These tentative dimensions, naturally, will be modified if the calculations subsequently made lead to unsatisfactory results.

The ports are arranged to extend practically all around the cylinder. As shown in Fig. 10, there are three inlet and three exhaust ports, the individual ports being separated by small bridges which serve to reinforce the cylinders, to support the piston rings and (on the exhaust side only) as passages for the cooling water. The circumferential width of the ports is

$$b = 3.85 \text{ in.},$$

which leaves sectors of about 36 deg. width that are not utilized for the flow of gases. It follows that the total area of the ports is

$$0.906 \times 3.85 = 3.49 \text{ sq. in. for the exhaust and}$$
$$0.67 \times 3.85 = 2.58 \text{ sq. in. for the inlet.}$$

From the timing diagram it will be seen that for the exhaust we have $2\ \Theta = 170$ deg., and for the inlet $2\ \Theta = 140$ deg., and allowing for a phase difference ϕ of 21 deg. for the two pistons, we get for the various angles

$$\theta' = 49°, \quad \gamma' = \Theta - \theta' = 36°, \quad \delta' = 6°$$

A graphic determination (Fig. 9) of the port capacities then gives for the exhaust

$$E = 400 \text{ sq. in.-deg.}$$

while for the port capacity of the exhaust ports up to the moment of inlet-port opening ($\delta' = 36$ deg.) we find

$$e' = 44 \text{ sq. in.-deg.}$$

This latter value can be checked by means of equation 19

$$e' = b\left\{\left(h_o - r + \frac{r}{8\lambda}\right)\left(\Theta - \theta'\right) + \frac{180}{\pi}\left[r\left(\sin\Theta - \sin\theta'\right) - \frac{r}{16\lambda}\left(\sin 2\Theta - \sin 2\theta'\right)\right]\right\}$$

$$3.85\left\{\left(0.906 - 1.15 + \frac{1.15}{8 \times 1.97}\right)\left(85° - 49°\right) + \frac{180}{3.14}\left[1.15\left(0.996 - 0.755\right) - \frac{1.15}{16 \times 1.97}\left(0.174 - 0.990\right)\right]\right\} = 44.1 \text{ sq. in.-degs.}$$

Thus the graphical and analytical results are in close agreement. As is clearly shown by Fig. 7, the piston heads in this case are domed, and the values of the discharge areas through the ports must be multiplied by the cosine of 30 deg., since the outer portion of the piston head is inclined approximately 30 deg. to a

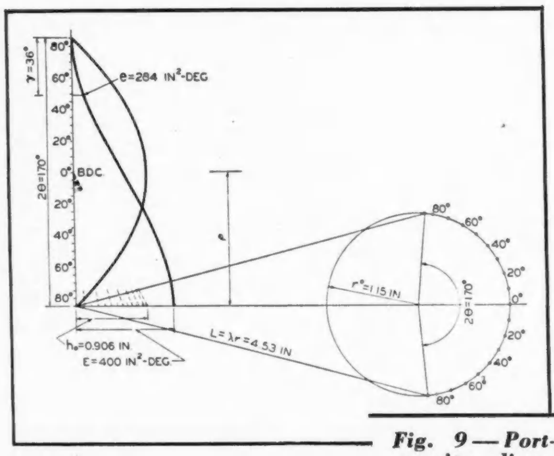


Fig. 9 — Port-capacity diagram

plane perpendicular to the piston axis. The value of e' is then reduced to

$$44 \times 0.866 = 38.1 \text{ sq. in.} - \text{degs.}$$

We must now determine what will be the pressure p' at the beginning of the exhaust period, whereupon we may trace the diagram of the engine cycle. We begin by determining the volumes V' and V'' occupied by the burnt gases when the exhaust and inlet ports begin to open respectively, that is, at the beginning and the end of the pressure-equalization period. We also determine the volume V''' occupied by the fresh charge at the moment the inlet ports close, that is, at the beginning of the compression period. Let g' and g'' be the distances traveled by the exhaust-control piston and the inlet-control piston, respectively, between the opening of the exhaust ports and the opening of the inlet ports, that is, during the time the exhaust-control crank turns through the angle γ'; and let g''' be the distance traveled by the exhaust-control piston from the time the exhaust port closes to the time the inlet port closes, that is, during the time corresponding to a crank angle δ'. We obviously have

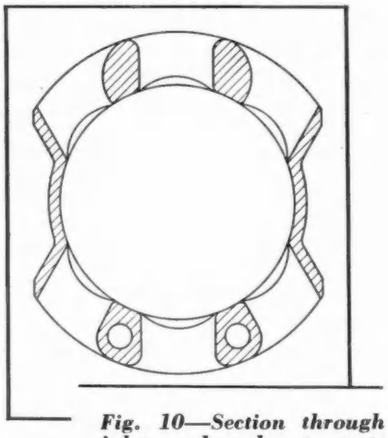


Fig. 10—Section through inlet and exhaust ports

$$g' = 2r\left[\frac{1-\cos\gamma'}{2} - \frac{1}{8\lambda}\ \frac{1-\cos 2\gamma'}{2}\right]$$

Similar equations may be derived for g'' and g'''. These values may also be found by means of an accurate graphic construction in accordance with the timing diagram. If h_{os} and h_{oa} are the total heights of the exhaust and inlet ports, we have

$$\left.\begin{aligned} V' &= V_c + \frac{\pi d^2}{2}\left[2c - h_{os} - (h_{oa} + g'')\right] \\ V'' &= V_c + \frac{\pi d^2}{4}\left[2c - (h_{os} - g') - h_{oa}\right], \\ V''' &= V_c + \frac{\pi d^2}{4}\left[2c - h_{oa} - (h_{os} + g'')\right] \end{aligned}\right\} \quad . . (26)$$

It should also be noted that, owing to the phase difference ϕ between the two pistons, the compression space will be a minimum not when one or the other is in the dead-center position, but when they are equal distances from this position; that is, when the exhaust-control piston has already traveled outward a distance i corresponding to the angle $\phi/2$, while the inlet-control piston still has to travel a like distance to reach the inner dead-center position. Having obtained the value of i from the equation

$$i = 2r\left(\frac{1-\cos\frac{\varphi}{2}}{2} + \frac{1}{8\lambda}\ \frac{1-\cos\varphi}{2}\right)$$

we may calculate the effective value of the compression space from the equation

$$V_{c\,eff.} = V_c + \frac{\pi d^2}{4}\cdot 2i$$
$$= V_c + \frac{\pi d^2 i}{2}.$$

To calculate the final compression pressure it is now necessary to introduce the conception of the effective compression ratio, the same as is done in the case of non-supercharged four-stroke engines by using a "corrected volumetric ratio" which takes into account the volumetric efficiency of the cylinder[1].

$$\rho_{eff.} = \frac{V'''}{V_{c\,eff.}},$$

which, owing to the phase difference between the pistons, is necessarily smaller than the apparent compression ratio

$$\rho = \frac{V_h + V_c}{V_c}$$

Assuming that compression takes place in accordance with a polytropic curve having an exponent of $n = 1.4$, which is in agreement with experimental data; and that at the moment of inlet-port closing the whole of the volume V''' is filled with charge at a pressure p''', equal to the blower delivery pressure p_1 reduced by a suitable percentage to allow for pressure loss in the pipe connecting the supercharger with the engine and in the ports, the final compression pressure will be given by the equation

$$p_2 = p''' \times \rho_{eff}^{1.4}$$

The explosion pressure p_3 in engines of the type here considered is always very high, and the exponent of the following polytropic expansion may be evaluated from indicator diagrams taken on similar engines. In general we may assume that p_3 will lie between 50 and 55 atmospheres abs., and that the mean value of the exponent of the expansion curve will be $n = 1.20$ to $n = 1.25$, this low value of the exponent taking account of the fact that combustion continues during the entire expansion stroke.

This theoretical value of p_3 can be checked, moreover, by comparing the product of the mean indicated pressure given by the diagram and a suitable value for the mechanical efficiency with the brake mean effective pressure estimated in the course of design of the engine. We then have

$$p' = p_3\left(\frac{V_{c\,eff.}}{V'}\right)^{1.25},$$

where the exponent 1.25 has been assumed. The corresponding temperature

$$T' = \frac{p'\,v'}{R}$$

may be easily obtained, as we may consider the specific volume of the gases at the beginning of the compression period in the cylinder to be known

$$v''' = \frac{R\,T'''}{p'''}.$$

We then have

$$v' = \frac{V'}{V'''}\,v'''$$

On the basis of the foregoing relations, an indicator

[1] See R. Devillers, Les Moteurs a Explosions, Vol. I, pp. 59 and 65.

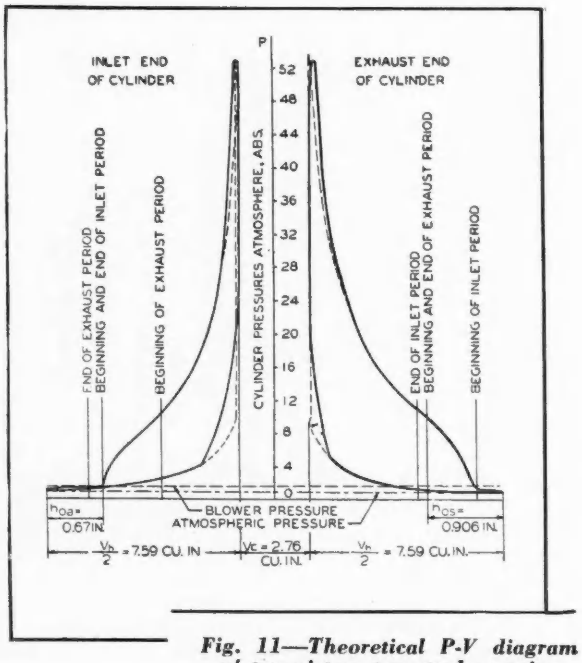


Fig. 11—Theoretical P-V diagram of two-piston, two-stroke engine

card of the engine considered in this section has been drawn in Fig. 11. We then have

$$g' = 0.592 \text{ in.} \qquad g'' = 0.709 \text{ in.} \qquad g''' = 0.117 \text{ in.}$$
$$V' = 10.40 \text{ cu. in.} \quad V'' = 14.67 \text{ cu. in.} \quad V''' = 12.34 \text{ cu. in.}$$
$$i = 0.0256 \text{ in.}$$
$$V_{e\,eff.} = 2.925 \text{ cu. in.} \qquad \rho_{eff.} = 4.22$$

It will be assumed that the pressure developed by the supercharger at speeds of between 6000 and 7000 r.p.m. is approximately 1.45 atmospheres abs., and that by careful design of the connecting pipes and proper rounding of the edges of the inlet ports, the pressure drop in the pipes and ports can be held down to 0.05 atm. Then, making

$$p''' = 1.40 \text{ atmos. abs.,}$$

we will have

$$p_2 = 1.40 \times 4.22^{1.4} = 10.51 \text{ atmos. abs.}$$

The two end points of the polytropic expansion curve thus being known, the curve can be easily traced after a sufficient number of its points have been located[2].

Thus if we assume the explosion pressure p_1 to be equal to 53 atmos. abs., we get

$$p' = 53\left(\frac{2.925}{10.40}\right)^{1.25} = 10.28 \text{ atmos. abs.,}$$

and if the temperature of the charge upon entering the cylinder, T''', is supposed to be 546 deg. R. (86 deg. Fahr.), which presupposes the use of an intercooler, we get

$$v''' = \frac{53.3 \times 546}{2116 \times 1.4} = 9.83 \text{ cu. ft. per lb.}$$

and

$$v' = 9.83\left(\frac{10.4}{12.34}\right) = 8.30 \text{ cu. ft. per lb.}$$

from which we get

$$T' = \frac{2116 \times 10.28 \times 8.30}{53.3} = 3390 \text{ degs. R,}$$

or 2930 deg. Fahr.

In drawing the indicator diagram, it is advisable, for the sake of greater clearness of construction, to take the distances traveled by the two pistons for abscissas, assuming a single pressure axis for both cycles, arranged to coincide with the center of the cylinder. It must be borne in mind, moreover, that if we consider combustion to be completed instantaneously, on the exhaust side of the diagram there would be a continuation of the compression period beyond the point where the piston starts on its return stroke, extending over the distance i already calculated. In the same way, for the inlet side of the diagram, combustion would be completed before the inner dead center had been reached and a slight expansion would follow in spite of the fact that the piston continues to travel in the same direction. This theoretical diagram is shown in Fig. 11 by dotted lines. But combustion is far from instantaneous, and continues during the period of expansion, with the result that the exponent of the expansion line will be materially lower than that of the adiabatic. For this reason it is necessary to give the ignition considerable advance, as much as 50 to 60 deg. with respect to the dead center point. This modifies the diagram as shown by the full line in Fig. 11, which agrees satisfactorily with one obtained from an engine actually built.

From the value of p' we are able to obtain, by means of the equations developed in Section III, the thermodynamic efficiency corresponding to a drop in pressure p''' (from p' to p''). Since

$$p' = 10.28 \text{ atmos. abs.} \quad \text{and} \quad p = p'' = 1.4 \text{ atmos. abs.}$$

we get

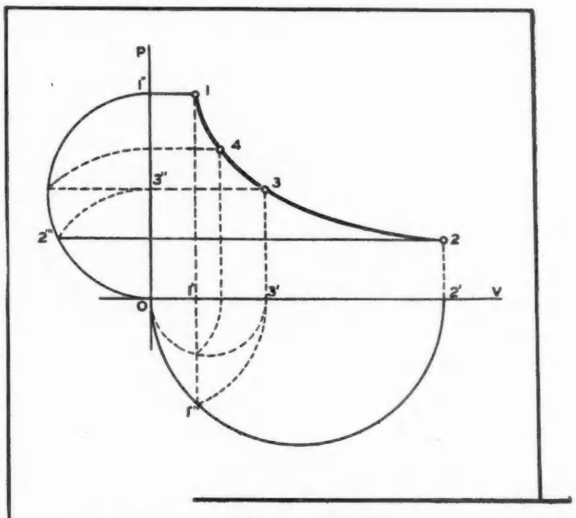


Fig. 12—Illustrating method of constructing polytropic expansion curve

[2] It may be well to briefly explain this graphical construction, which is not generally included in treatises on thermodynamics. Referring to Fig. 12, let 1 and 2 be the end points of the polytropic curve which we wish to trace. We first draw a semi-circle on the base O-2′ (which represent the cylinder volume at the beginning of the compression stroke). Then, with the point of the compass in O, the point 1″′, of intersection of a vertical dropped from 1 with the semi-circle O-2′, is transferred to 3′ on the base line O-2′. In the same way, still with the point of the compass in O, we transfer point 2″′, the point of intersection of the horizontal line through 2 with the semi-circle on the base O-1″, to 3″. O-3′ and O-3″ are coordinates of the point 3, which lies on the polytropic curve. This is so because

$$v_3 = \sqrt{v_1 v_2}, \qquad p_3 = \sqrt{p_1 p_2},$$

and, consequently,

$$p_3 v_3^n = p_1 v_1^n = p_2 v_2^n$$

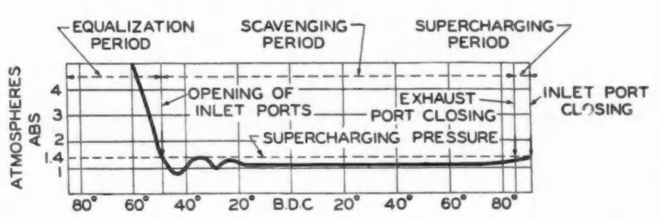


Fig. 13—Cylinder pressure during blow-down and scavenging periods

Substantially similar values for the required port capacity e' are obtained by an application of the equations of Section II.

By reference to Fig. 9, which gives the port capacity of the exhaust ports corresponding to any crank angle, and making use of equation (15′), we can calculate the cylinder pressure for any moment of the pressure-equalization period and thus complete the indicator diagram given in Fig. 11. In this connection it is well to remember that light-spring indicator diagrams taken on two-stroke engines of this type show that at the end of the pressure-equalization period a number of rapid oscillations of pressure occur within the cylinder, which sometimes reach a considerable amplitude. The pressure oscillations, whose mean value corresponds to the pressure in the exhaust manifold, die out rapidly, and the pressure in the cylinder begins to rise and to approach that of the blower delivery even a little before the exhaust port closes. Pressure equal to that of the supercharger is reached at the moment the inlet ports close (Fig. 13).

From the indicator diagram, taking account of the scale to which it is drawn, the m.e.p. of the engine under design can be obtained. Owing to the assumptions made, the area of the *p-v* diagram for the exhaust-port end of the cylinder is greater than that of the diagram for the inlet-port end of the cylinder, and this is clearly shown by Fig. 11. In this particular case the indicated mean effective pressures are 11.8 atmospheres abs. and 10.8 atmospheres (159 lb. per sq. in.) net.

$$K = 1.21 \times \frac{1}{0.9} \times \frac{0.00603}{3390} = 0.000139$$

(where 0.9 is the coefficient of efflux; 0.00603, the value of V', the volume of the combustion chamber at the moment of exhaust-port opening, in cu. ft., and 3390, the temperature of the burnt gases at the moment of exhaust-port opening in degrees Rankine, or degrees Fahrenheit abs.

For the required port capacity we then get

$e' = 0.000139 \times 0.296 \times N$ sq. ft.-deg., or

$0.02 \times 0.296 \times N$ sq. in.-deg.

Consequently we would require

For $N = 6000$, $e' = 35.5$ sq. in.-deg. (approx)

$N = 6500$, $e' = 38.5$ sq. in.-deg.

$N = 7000$, $e' = 41.5$ sq. in.-deg.

These port-capacities, even though rather liberal, may be considered satisfactory in view of the high speed of the engines. Besides, even considerable changes in the value of the port capacity may be effected by varying the phase difference between the two crankshafts.

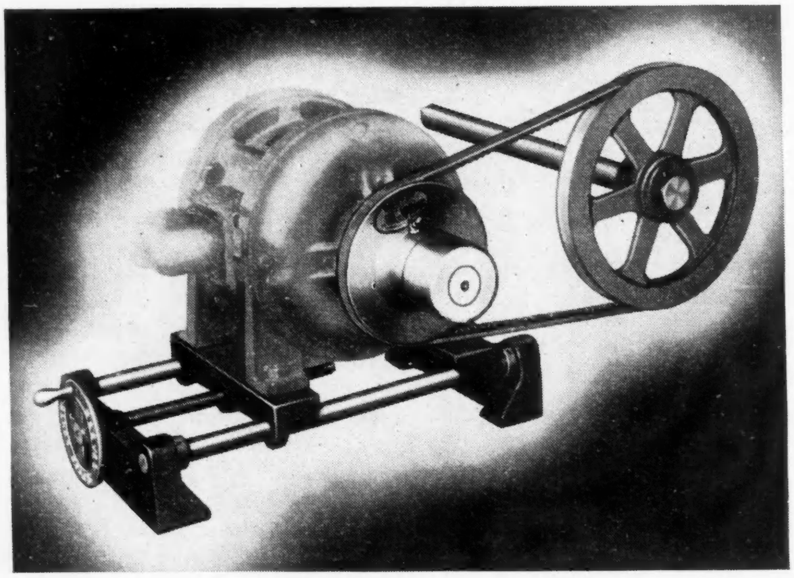
Drawing Tests for Sheet Metal

A LENGTHY research report on Drawing Tests for Sheet Metal appears in the May issue of *The Journal of the Institution of Automobile Engineers*, the author being Prof. H. W. Swift of the Sheffield University.

In the conclusions it is stated that the cupping test is representative of flanged pressings and the drawing test of pressings drawn through without a flange. Each of the two forms of test has its proper place in connection with commercial press operations, and the most appropriate one should be selected on the basis of practical requirements. There are many pressings which cannot be definitely classified as belonging to one or the other type, and in such cases both forms of test should be specified. A single machine could easily be designed to carry out both tests by simple adjustment, provided that a solid punch is adopted for the cupping test, instead of fluid pressure.

The research work carried out in connection with the drawing test indicated that in order to ensure accuracy and absence of burrs, the test blank should be machined on its outer edge. To minimize the effects of drawing speed and parasitic friction, graphite lubrication should be employed. Some system of pressure blank holder would be more convenient than positive blank holders, and it was suggested that fluid pressure be employed. Sufficient radial clearance should be provided between the punch and die to prevent ironing, except during the final stage of pressing. The die profile should be provided with as generous a curvature as possible without risk of "puckering." A generous curvature should be provided on the punch. For the single-stage drawing test, and probably also for the cupping test, a hemispherical end is most suitable; but for two-stage tests the first stage pressing should preferably have a partially-flat base. The linear scale of the test should be large enough to permit satisfactory accuracy, and experience with a 2-in. punch suggests that this is ample for the purpose but that an appreciably-smaller punch would involve a sacrifice in accuracy.

As regards the cupping test which might be combined with a drawing test on the lines defined in the foregoing, the same die and hemispherically-headed punch, and the same method of blank-holding might be adopted, the only difference being in the size of the blank, which for a 2-in. punch might well be of 5-in. diameter, or for a 1½-in. punch, 3½ in. An autographic record similar to that in the drawing test would show the load and penetration at rupture.



MEN

Reeves "Vari-Speed Jr." variable speed control unit

Every piece of machinery in the Pontiac plant is represented on this accurately scaled floor plan by cardboard models. All of the large automobile producers utilize this method to obtain the most efficient positioning and sequence of operations for production equipment

THE National Youth Administration for Ohio has published a most interesting work under the title of "The Machine Tool Industry in Ohio." It is the fifth in a series of occupational studies undertaken by the NYA for Ohio. The purpose of these studies is threefold: 1. To acquaint young persons with various occupations so that they may have reliable information to aid them in planning their future work; 2. To make available non-technical descriptions of America's industries, so that all persons may have accurate information about modern processes and about the workers who work with them; 3. To assist workers to recognize the importance of other employes' tasks, and to assist them to understand how the work of one individual is related to, and may affect, the work of many others. Within the 129 mimeographed pages of this neatly bound volume there is much information that readers of *Men and Machines,* especially those who are interested in apprentice training, might examine with profit.

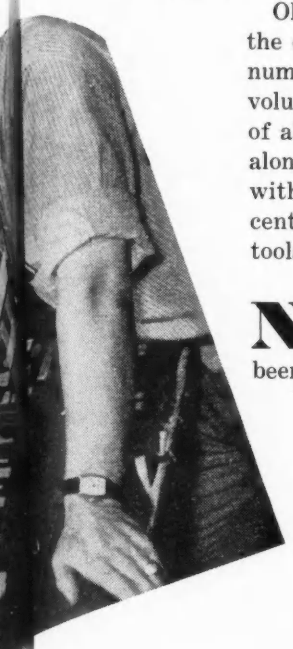
"The Machine Tool Industry in Ohio" was written by Wilbur R. Hanawalt, assistant in charge of Occupational Research of the NYA for Ohio. Nineteen plants visited in the course of the study employed a total of 11,944 workers in 1937, or 68.6 per cent of the 17,414 total employes reported in Ohio's machine tool industry by the U. S. Census of Manufacturers, 1937.

The contents of the book are presented under the following headings: The Master Tools of the Industry; The Story of Machine Tools; How Machine Tools Are Made; Qualifications for Machine Tool Work; Training for Machine Tool Occupations; Working Conditions in a Machine Tool Plant; Sizing-Up Machine Tool Occupations. An appendix lists the job titles commonly applied in the industry, the amount of time required to develop skill in various types of work, and average earnings of employes in different classifications.

In this study, John Steptoe is credited with establishing the first machine tool plant in Ohio shortly after the Civil War. One of his employes, William Lodge, played a vital part in the next significant development by establishing a plant in Cincinnati in 1880 for the production of a standard line of machines with interchangeable parts. A year later Worcester R. Warner and Ambrose Swasey opened a plant for manufacturing machine tools in Cleveland. Today, Ohio's machine tool industry includes 69 plants employing

and MACHINES

14,527 workers according to the 1937 Census of Manufacturers. The same source shows that this industry in Ohio paid total wages of $24,118,175 and produced products with a total value of $80,111,824 in 1937. Most of the machine tool plants employ fewer than 100 workers, but several large organizations raise the average to 210.



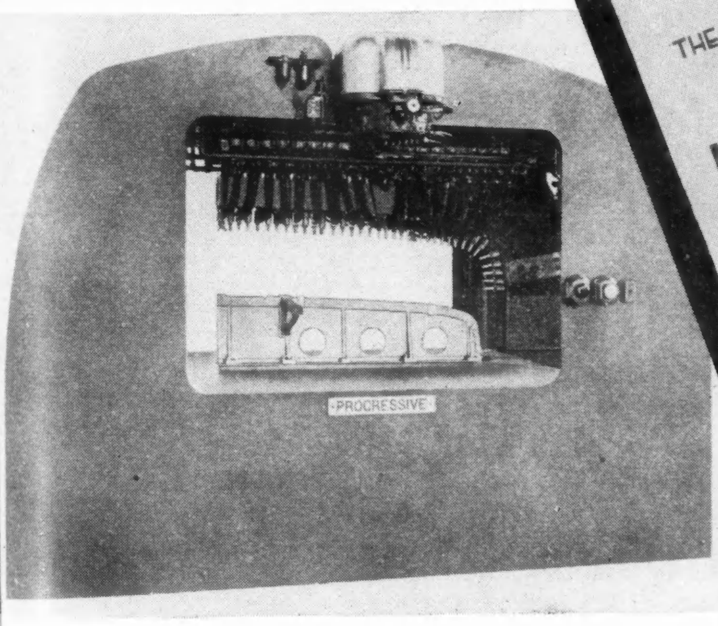
Ohio is in the vanguard of all states in the output of machine tools and also in the number of workmen employed. On a dollar volume basis, its plants produce 30 per cent of all machine tools. The City of Cincinnati alone includes a third of the Ohio industry within its area. Cleveland also is a major center. Among all Ohio industries, machine tools rank ninth in number of workers.

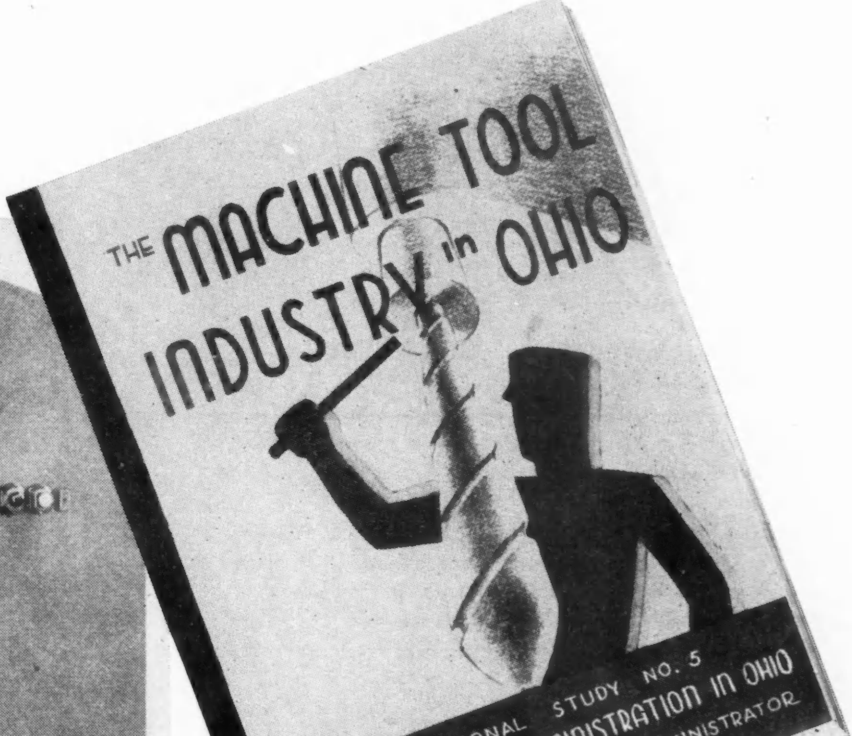
NUMEROUS innovations and improvements in manufacturing methods have been devised to facilitate economical production of parts for semi-automatic automobile transmissions. Some of these now are in operation producing components for assembly into 1941 models. A typical operation is illustrated herewith (Page 171). The part, shown in the foreground, is a gear out of a 1941 semi-automatic transmission. The operation required is to cut slots shown on the front side. These slots have to be held to 0.003 in. for size and 0.002 in. for centrality with the bore.

A broaching machine used for this job has broaches of floating construction which are pulled through broach guides and work by broach pullers connected with the ram in the base of the unit. The fixtures which locate the parts during cutting serve as guides for the broach so that any weaving or distortion below or above the fixture during broaching has no effect on the actual cutting itself.

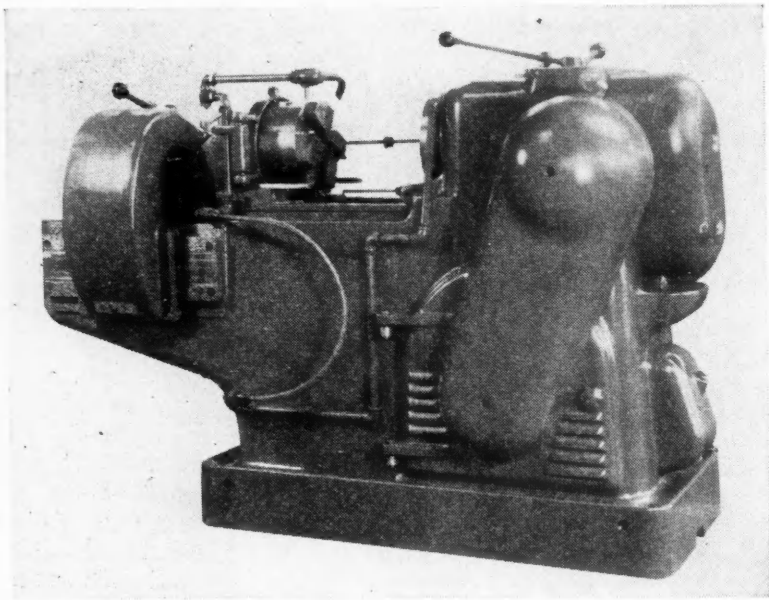
The broach guides incorporate a pilot for locating the part, thereby assuring accuracy of location of the machined slots in relation to the bore of the part.

Spot welder capable of making upwards of 6000 spot welds per hour built by the Progressive Welder Co.





Cover design of the 119-page mimeographed book "The Machine Tool Industry In Ohio" by Wilbur R. Hanawalt, assistant in charge of Occupational Research of the National Youth Administration for Ohio



Rear view of a Landis "Landmaco" threading machine developed for special threading operations

To provide ease of loading, the fixture table is of the receding or shuttling type, while the fixture on which the parts are loaded is of the trunnion or "tilting" construction.

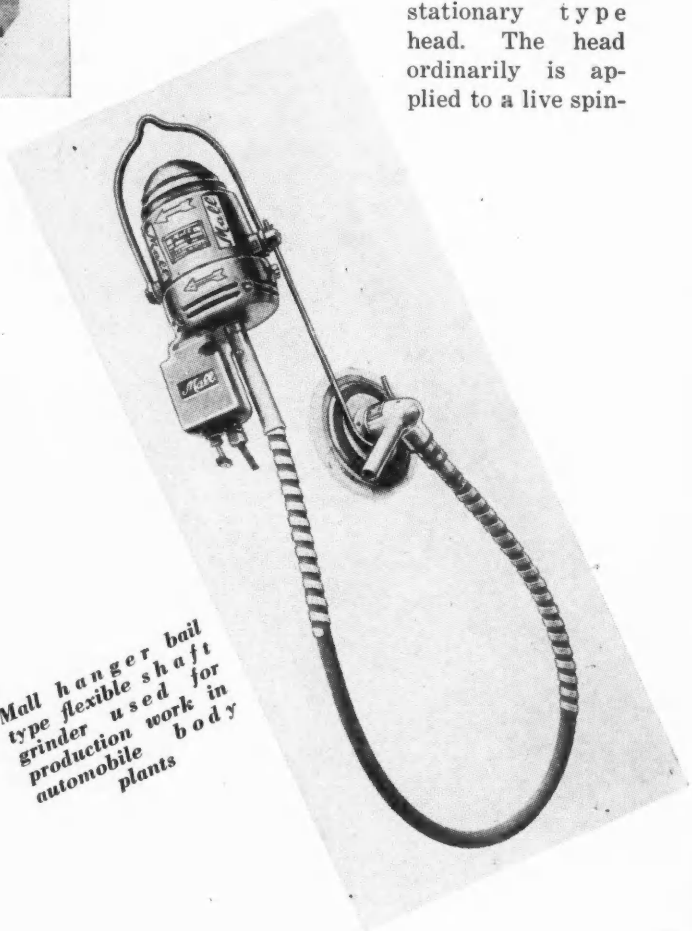
In operation, two parts are placed over studs on the fixture while in the position shown. Just before the machine ram starts down, the fixture table starts to move in toward the broach guides. As it does, the fixture tilts forward, so that, as the table finishes its forward movement, the bores of the two parts are located over the pilots in the broach guides.

At this point, the machine ram has started to move down. The broach pullers—permanently connected to the broaches—pull the tools through the guides, rough and finish cutting the slots. At the end of the down stroke, the fixture table automatically shuttles backward, out of the way, at the same time tilting the fixture backward. The machine ram now moves upward to starting position, while the operator removes the two finished parts and drops two others over the fixture studs shown. Two fingers are provided to hold the parts in place on the tilting fixture until they have been locked against the work pilots in the broach guides. This design eliminates manual chucking of the parts.

Cutting speed is 30 ft. per min. with a return stroke of 60 ft. per min. Production is at around 240 pieces per hour with two parts finished for each cycle of the machine. The five-ton, 42-in. stroke single ram machine, fixtures, and broaches were designed and built by Colonial Broach Co., Detroit.

THE "Landmaco" machine, illustrated herewith, is one recently developed by the Landis Machine Co., Inc., Waynesboro, Pa., for handling threading operations in which extremely close tolerances for concentricity must be maintained between the thread and the body of the work. Inasmuch as such work usually is ground, the grinding operation being handled by supporting the work between centers, provision is made on this equipment for supporting the work in like manner.

Mechanical features of the Landis unit include a face plate on the machine spindle supplanting the usual die head, a carriage front on which the die head is mounted, and a tail stock which is adjustable and which also supports a center. The face plate, which also incorporates a live center, is employed in exactly the same manner as the face plate on a grinding machine or lathe, that is to drive the work with the use of a dog. The special carriage supports the "LANCO" die head which is, in this case, used as a stationary type head. The head ordinarily is applied to a live spindle. Provision is made for opening and closing the die head with a yoke when it is necessary to do so.



Mall hanger bail type flexible shaft grinder used for production work in automobile body plants

The adjustable tail stock is clamped into position on ways located on the side of the machine bed. These ways are of sufficient length to permit handling work ranging from 2 in. long to 16 in. long. The tail stock center is advanced to or withdrawn from the work by a quick acting lever located on the top of the tail stock where it is convenient for the operator. The movement of this center is actuated by means of a rack and pinion gear. The center can be clamped rigidly into position by means of a clamping lever also located on top of the tail stock.

This machine is of the leadscrew type. The thread

is generated by revolving the work between the centers, the die head being propelled onto the work and the thread lead being controlled by means of the leadscrew.

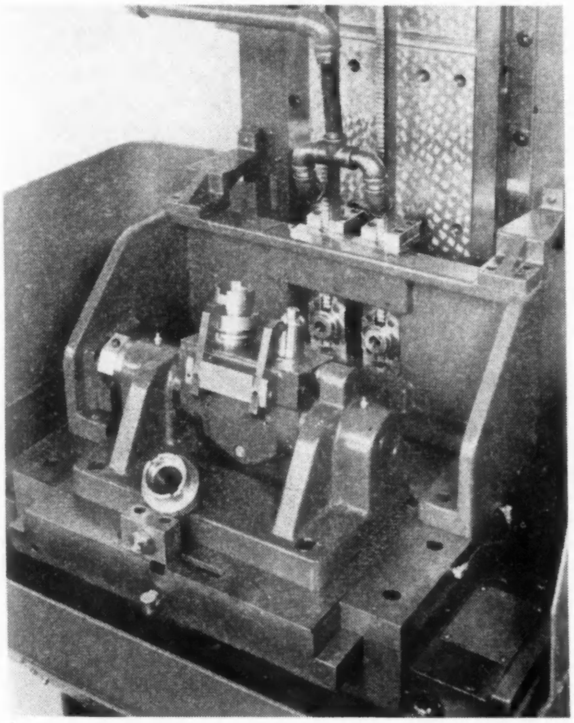
REEVES PULLEY CO., Columbus, Ind., has announced the addition of the Vari-Speed, Jr., to its complete line of variable speed control equipment.

The standard unit comprises a disk assembly and adjustable motor base. The disk assembly consists of two cone-shaped disks (one stationary and one laterally adjustable), a self-adjusting tension spring, a spring adjusting nut and cover. This assembly is applied directly to the standard shaft extension of the motor and the motor is mounted on an adjustable base. The V-belt, driving between the two disks and the sheave pulley on the driven shaft, is a standard section "A" or "B" belt, and may be secured from any industrial supply house.

By means of an adjustting handwheel, the motor is moved forward and back. When nearest to the driven sheave, the V-belt runs over the largest diameter on the disks and maximum speed is secured. Reversing the handwheel moves the motor away from the driven sheave, the V-belt runs over smaller diameter on the disks (the adjustable disk moving out to accommodate the belt), and speed is reduced. When the motor is farthest from the driven sheave, minimum speed is attained.

Speed variation is "infinite" within the limits of the unit—that is, a countless number of operating speeds is available without "steps" or "jumps"—and is accomplished while the machine is running and without interrupting production.

Colonial single ram broaching machine set up for "four-a-minute" operation on semi-automatic transmission gears

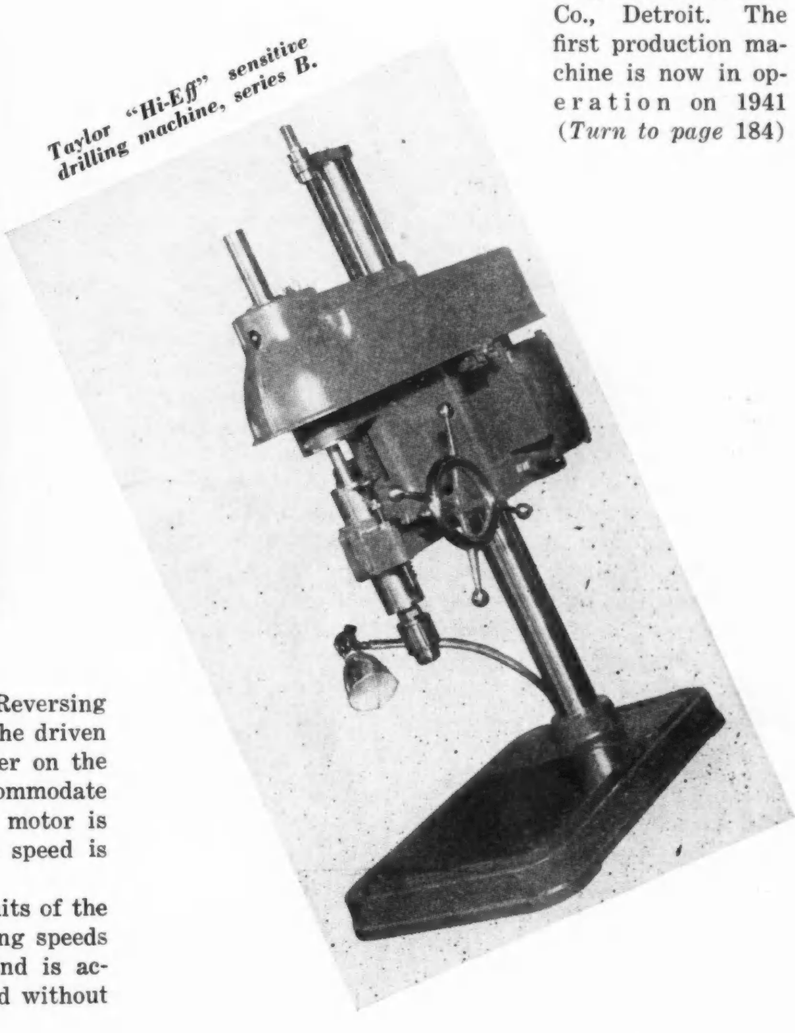


Colloid Equipment Co.'s new moisture detector.

The Vari-Speed Jr. is built in six different sizes of disk assembly, for use with motors of from 1/8 to 1½ hp. and provides speed control over a range of from 1¾:1 to 2¾:1, inclusive, depending upon the size, horsepower and speed of unit selected. Two sizes of motor bases are available, according to the size of motor. Either size base may be used with any one of the six disk assemblies. The unit is also available in a countershaft type for requirements of either unusual speed reduction or speed increase.

A HIGH-SPEED spot welder capable of making upwards of 6000 spot welds per hour has been announced by the Progressive Welder Co., Detroit. The first production machine is now in operation on 1941 (*Turn to page* 184)

Taylor "Hi-Eff" sensitive drilling machine, series B.



Production Lines . . .

Diesel Service

Out of a scrap book of pioneering operation of Diesel-powered motor vehicle equipment, W. J. Cumming, general superintendent, Surface Transportation Corp., has prepared a practical manual on the maintenance of Diesel engines. This has been issued in the form of a small book, packed with practical information and recommendations, entitled, "Automotive Diesel Maintenance" just published by the Pitman Publishing Corp. Among the topics covered in the manual are—fuels, fuel injection, timing, bearings, lubrication, salvage methods, engine operation including starting troubles and smoke and trouble-shooting, maintenance in relation to fuel economy. A valuable chapter is devoted to an approved and time-tested maintenance scheme; another to a shop layout for efficient engine servicing and repair. Timely and informative, this book should be of more than passing interest to designers, service engineers, and fleetmen.

Styling Moderne

Biggest feature of the 1941 cars, judging by some we have seen by now, is that of styling. But styling will have a new meaning this season. Gay two-tone color combinations—two-tone interior trim treatment—generous use of decorative body moldings and fender skirt trim. Zinc die cast grilles, and other zinc castings account for still greater tonnage of metal than ever before. More plastics are noted—but not yet in the large areas talked about in recent months. This year the license plate becomes a part of the front structure, instead of being simply a loose appendage. On certain makes, the plate is framed right in the front bumper center section. Needless to say, this introduces a cooling problem due to eddy currents and actual deflection of the frontal air stream. To meet the situation, side grilles are larger in area, do most of the work of cooling, may possibly lead to a rudimentary front grille.

On Lighting

We understand that Polaroid has developed a new type of polarizing material which is stable in composition and, consequently, suited for long time exposure in automobiles. It seems practical now to consider this material for use in headlamp lenses and windshield visors. However, the practical problem of the future still remains one of greatly increasing the intensity of the light source—perhaps to the point of using the 100-watt lamps so talked about several years ago. Of course, this change is not so simple as it sounds. It will require larger generators, heavier conductors, special relays, larger current-voltage controls. All of this reduces down to a question of cost. And that will be the pivotal problem somewhere in the future of the headlighting question.

Coatings Grows

Within a short space of time the applications of chemical coatings such as Parker and A.C.P. have grown amazingly. They are widely used on camshafts, valve lifters, and a host of other parts. Interesting use of Granodizing is found in the treatment of differential spiders to overcome initial break-in seizure and to prevent corrosion. Novel development is the use of such chemical coatings for gears, thus providing self-lubricating properties in pressure areas where initial break-in may be a serious hazard.

Surface Finish

A first hand impression shows unmistakably that the standardization of surface finish has spread widely in the industry. Most recent applications of the Profilometer are found in the Detroit Transmission Div., of General Motors, at Studebaker, at Caterpillar, and others. Studebaker, for example, has a roving quality man whose job is to sample crankshafts, camshafts, and other parts, daily with a Profilometer. Crankpins and journals are held within four to six micro-inches.

Tension Devices

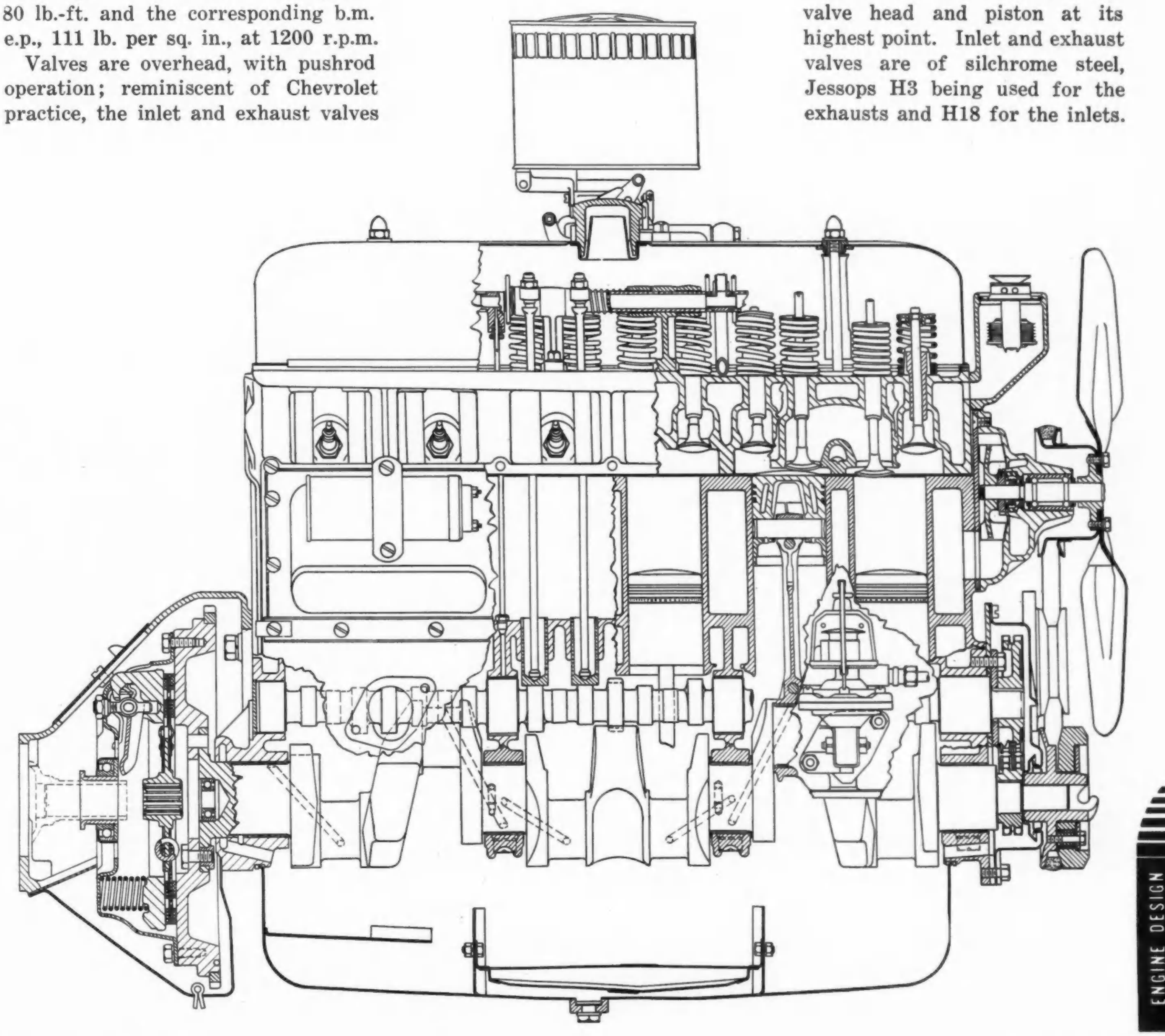
An exhaustive mathematical treatment of tensioning mechanisms was presented by Daniel Vaughn Waters in a lecture at the Cooper Union some short time ago. In his analysis the author divided the subject into two main headings—supply tensioning mechanism and take-up tensioning mechanism. This discussion is particularly timely due to the growing use of coiled and reeled strip metal in automotive plants. The paper was not published but the author could probably be reached by correspondence with the Cooper Union, New York.—J. G.

VAUXHALL SIX-CYLINDER 14-Hp. ENGINE

Longitudinal Section

This engine, manufactured by Vauxhall Motors, British subsidiary of General Motors Corporation, for use in a four-five-passenger car, has a bore of 2 5/16 and a stroke of 3 15/16 in., giving it a piston displacement of 108 cu. in. With a compression ratio of 7 it develops 48 hp. at 3800 r.p.m. Its maximum torque is 80 lb.-ft. and the corresponding b.m.e.p., 111 lb. per sq. in., at 1200 r.p.m.

Valves are overhead, with pushrod operation; reminiscent of Chevrolet practice, the inlet and exhaust valves are staggered in the cast-iron head and slightly inclined from the vertical in opposite directions. The exhaust valve has its seat at the top of a pocket offset relative to the cylinder bore; the inlet seating is located above the other side of the bore, where there is the minimum of clearance between the valve head and piston at its highest point. Inlet and exhaust valves are of silchrome steel, Jessops H3 being used for the exhausts and H18 for the inlets.



VAUXHALL SIX-CYLINDER 14-Hp. ENGINE

Transverse Section

Inlet valves have an effective diameter of 1⅜ in. with a lift of 0.340 in., while the exhausts have a clear diameter of 1¼ in., with 0.335 in. lift.

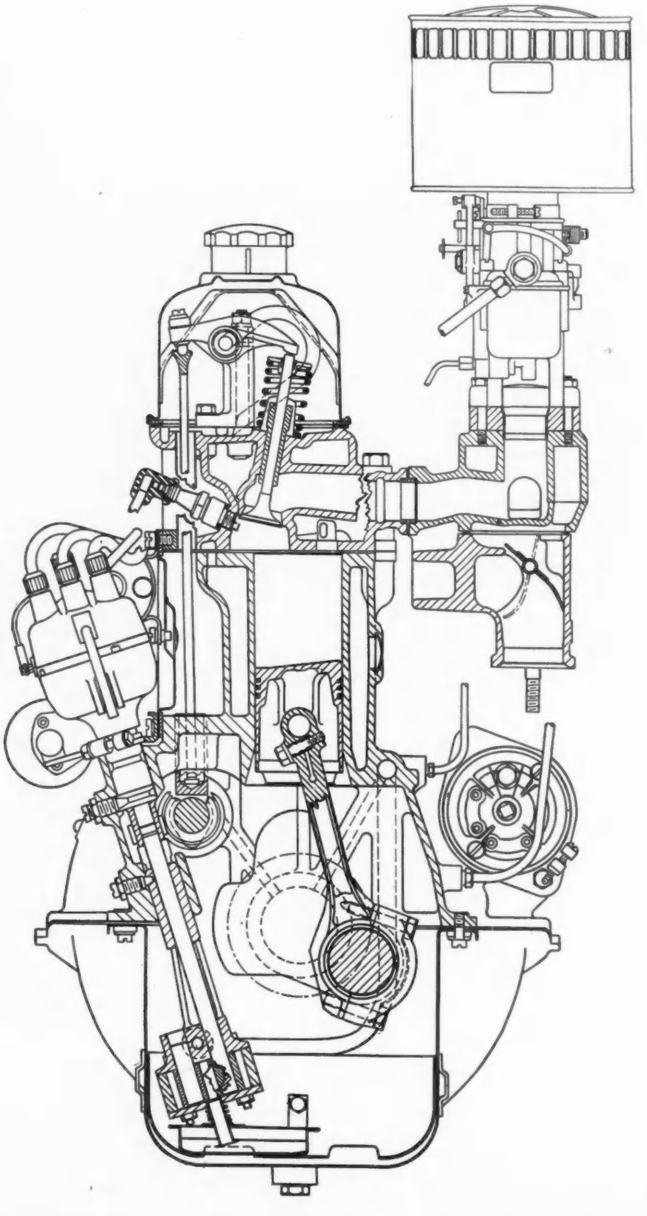
The counter-balanced, four-bearing crankshaft has a friction-type vibration damper combined with the fan pulley, and, like the connecting rods, has steel-backed white-metal bearings. Crankpins are of 1.875 in. diameter; journals, front to rear, are 2.062 in., 2.125 in., 2.187 in. and 2.250 in. in diameter. B.H.B. pistons of aluminum alloy are used, and have two individually-cast high-pressure rings and an oil control ring. The crown of the piston slopes down slightly from the inlet to the exhaust side.

Big-ends have caps secured by cap screws in place of bolts and nuts, and are diagonally split at an angle of only 32 deg. from the axis of the rod, to enable the rod to be withdrawn through the cylinder bore when the cap has been removed. To relieve the cap screws of shear stresses, the contacting faces of rod-end and cap have inter-locking serrations.

Water circulation is effected by an impeller at the front of the cylinder jacket, belt-driven with the ball-bearing fanshaft. Temperature control is by thermostatic valve located in the uptake without a by-pass. Cylinder jackets are full length, and directional spray tubes are employed in the head jacket to deliver water directly to the spark-plug and exhaust-seat areas.

A Zenith carburetor is used, with additional Vauxhall features, including an automatic part-throttle economy device, an accelerating pump, and an interconnection between choke and throttle. Ignition is by a Lucas high-voltage coil and distributor for 0.040-in. spark gaps; both vacuum and centrifugal timing control are provided, as well as a micrometer adjustment. A 12-volt electrical equipment is fitted in conjunction with a Lucas fan-cooled generator having compensated voltage control.

Lubrication is by pressure throughout, except to the piston pins. Big-ends are drilled to allow oil to be sprayed into the cylinder bores once every revolution. The engine has a downtake pipe for crankcase ventilation, and both internal and external oil filters. A three-point mounting on rubber blocks is provided for the powerplant; these blocks are pierced with "Z" slots and collapse under heavy loads so as to give a varying degree of flexibility. Without transmission, but including the clutch casing, clutch and lubricating oil, the engine weighs 450 lb.



NEWS OF THE INDUSTRY

Export Restrictions On Machine Tools "Relaxed"

Order Releases Some Types Of Equipment After Study Shows That National Defense Will Not Be Hampered

An order relaxing and clarifying the export licensing system governing machine tools has been issued by the State Department's Division of Controls and sent to Collectors of Customs. Machine tool experts on the staff of the National Defense Advisory Commission said that the order, recommended by Lieut. Col. Russell L. Maxwell, administrator of export control, was issued after ascertaining the items for which there is adequate capacity so that the defense program would not be impaired.

Pending further instructions, these items have been freed from the machine tool export restriction:

All used or rebuilt machine tools of any description, pipe threading machines, metal cutting band saws, power driven hack saws, keyseating machines, disk grinding machines, car wheel and locomotive wheel presses, burring machines—gear, burnishing machines—gear, planers—crank, bench power presses, saw sharpening machines, filing machines, pipe bending machines, thread chaser grinders, burnishing machines, tool and cutter grinders—universal and plain—hand feed, riveting machines, grinding machines—portable with flexible shaft, centering machines, grinders—face milling cutter, arbor presses — hand, air and hydraulic, grinding machines—drill, grinding machines—tap, grinding machines—hob, nibbling machines, grinders—lathe tool, gear lapping machines, gear shaving machines, polishing machines, heat treating furnaces, foundry machines.

Earlier, the State Department had specifically exempted these articles from the machine tool license requirements.

(*Turn to page* 182, *please*)

Harrison Radiator Building Addition to Lockport Plant

Construction has been started on a new $260,000 addition to the plant of the Harrison Radiator Division of General Motors Corp. at Lockport, N. Y.

Airport Facilities Rapidly Increasing

The Civil Aeronautics Authority has announced that there were 2655 airports, landing fields and seaplane bases in the United States on July 1, an increase of 204 over the figure registered on Jan 1, 1940.

This total includes 646 municipal and 495 commercial airports; 282 C.A.A. intermediate fields; 653 auxiliary fields; 20 naval air stations; 58 army fields, and 191 miscellaneous Government, private and State airports and landing fields. Of these, 775 were either fully or partially lighted for night flying.

Charles D. Hastings

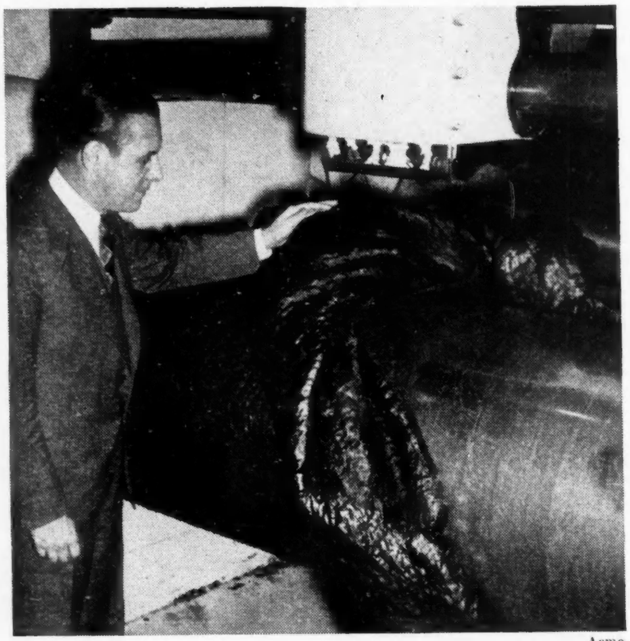
Charles D. Hastings, who retired as board chairman of Hupp Motor Car Corp. in 1935, died on Aug. 7. Mr. Hasting's long career in the automobile industry began in 1902 when he became associated with the Olds Motor Works as a salesman. Later he joined the Thomas-Detroit Co., and in 1908 started with Hupp.

Acme

"Jump Take-Off" Autogiro

A new model designed by the Pitcairn Autogiro Co., Willow Grove, Pa., which adds initial vertical ascent to the established autogiro characteristic of vertical descent and, slow safe flying speed. The new "jump takeoff" characteristic is obtained by speeding the rotor of the machine to about 50 per cent more than normal 200 r.p.m. while the blades of the rotor are held in "no lift" position. As the pilot declutches the engine from the rotor an interlocking mechanism permits the blades to assume their lifting angle. Simultaneous over-speeding and assumption of the "lift" position causes the machine to rise vertically for approximately 20 ft., after which it assumes a normal climbing angle at the will of the pilot. The PA-36, as the new model is called, is a two-place side-by-side cabin autogiro powered with a 175 hp. radial engine. Many automotive devices are used on the new craft, such as starting, lighting and ignition systems and a new type of rotor hub in which automobile type steering gear is incorporated to provide "irreversibility" to the controls

NEWS


Acme

Synthetic

Harvey S. Firestone, Jr., examines the mixing mill at the Firestone New York World's Fair tire factory where tires of synthetic rubber were manufactured publicly for the first time on August 3.

Goodrich and Phillips To Make Synthetic Rubber

Will Manufacture Under Firm Name Of Hydrocarbon Chemical & Rubber Co.

Stating their intention to increase the production of synthetic rubber so that additional commercial quantities can be made promptly available for use in national defense and throughout industry, David M. Goodrich, chairman of the board of The B. F. Goodrich Co., and Frank Phillips, chairman of the board of Phillips Petroleum Co., have announced the formation of Hydrocarbon Chemical & Rubber Co.

The new company acquires from Goodrich experience in the production and use of synthetic rubbers, and from Phillips the benefit of large resources of natural raw materials and a background of hydrocarbon research.

The speed with which the company plans to increase its production has been made practical, it was explained, because of the rapid strides within the past few months in developing compounds of these new materials for a large number of commercial needs. "In fact, it can be said that we have learned almost as much about processing synthetic rubber in 100 days as was learned about natural rubber in 100 years," the announcement declared.

The directors of Hydrocarbon Chemical & Rubber Co. representing Phillips Petroleum Co. are Frank Phillips, chairman; K. S. Adams, president and G. G. Oberfell, vice-president in charge of research. Representing the B. F. Goodrich Co. are David M. Goodrich, chairman; John L. Collyer, president and T. G. Graham, vice-president in charge of production.

In charge of sales for the new concern will be Ross W. Thomas, who is general manager of the Philgas division of Phillips. Dr. Waldo L. Semon will be director of research.

The new company's principal offices will be located in Akron, Ohio.

Sterling To Expand

The Sterling Engine Co. of Buffalo has filed plans to enlarge its building at a cost of $10,500.

Embargo Virtually Ends Aviation Gasoline Exports

An embargo on exports of aviation-type gasoline to all countries outside the Western Hemisphere was ordered by President Roosevelt on July 31—an action which has already prompted a protest from Japan. The restriction does not apply to the less volatile gasolines used in ground vehicles, although many petroleum products by an earlier order were made subject to an export license requirement.

Under the terms of a proclamation issued by Mr. Roosevelt on July 26, petroleum products, tetraethyl lead, and iron and steel scrap were brought within the licensing requirement under which export licenses must be obtained from the State Department's Division of Controls before exportation of these products is authorized.

Petroleum products were defined as "(a) Aviation Motor Fuel, i. e., high octane gasolines, hydrocarbons, and hydrocarbon mixtures (including crude oils) boiling between 70 deg. and 350 deg. Fahr., which with the addition of tetraethyl lead up to a total content of 3 cc. per gallon will exceed 87 octane number by the A.S.T.M. Knock Test Method; or any material from which by commercial distillation there can be separated more than 3 per cent of such gasoline, hydrocarbon or hydrocarbon mixture; (b) Aviation Lubricating Oil, i. e., any lubricating oil of 95 or more seconds Saybolt Universal Viscosity at 210 deg. Fahr. with a viscosity index of 85 or more."

Tetraethyl lead was defined as "pure tetraethyl lead, ethyl fluid, or any mixture containing more than 3 cc. of tetraethyl lead per gallon."

Iron and steel scrap was defined to

New Truck Registrations

In the table below are presented new truck registrations arranged in descending order by makes according to the accumulative six month totals for 1940. In addition to the customary data shown in these tables as they are published from month to month of current new registrations compared with the preceding month and a year ago, we are reprinting figures for April and May of 1940. While new registration data for these two months appeared in AUTOMOTIVE INDUSTRIES, July 15, 1940, those data were incomplete as they did not contain returns for the state of Oklahoma. As we are now receiving figures from this state the new registrations are now complete and the reprinting of the material for April and May will allow you to have complete records for 1940 to date.

	June	May	April	June	SIX MONTHS		Per Cent Change, 6 Months	Per Cent of Total Six Months	
	1940	1940	1940	1939	1940	1939	1940 over 1939	1940	1939
Chevrolet	14,246	16,962	19,429	14,049	99,177	88,883	+ 11.8	34.07	35.72
Ford	11,647	13,816	15,444	10,606	81,274	65.459	+ 24.0	27.92	26.31
International	6,291	6,743	7,049	5,105	37,573	30,677	+ 22.1	12.91	12.33
Dodge	4,412	5,459	5,654	4,442	29,567	27,057	+ 9.2	10.16	10.87
G. M. C.	3,357	4,334	4,071	2,740	21,085	16,572	+ 27.0	7.24	6.66
Plymouth	902	1,065	1,070	889	5,471	4,928	+ 11.0	1.88	1.98
White	574	631	840	434	3,519	2,204	+ 60.0	1.21	.89
Mack	561	756	656	588	3,504	3,168	+ 10.4	1.20	1.27
Diamond T	533	501	563	408	3,131	2,431	+ 29.0	1.07	.98
Willys-Overland	188	225	222	185	1,223	829	+ 47.8	.42	.33
Divco	107	187	165	90	898	781	+ 14.8	.31	.31
Federal	116	151	152	123	846	734	+ 15.3	.29	.29
Autocar	127	158	156	162	815	922	− 11.7	.28	.37
Brockway	121	143	102	177	698	886	− 21.3	.24	.36
Studebaker	103	112	133	209	688	1,080	− 36.4	.24	.43
Hudson	67	92	92	47	443	274	+ 61.5	.15	.11
Bantam	24	41	51	50	258	275	− 6.2	.08	.11
Sterling	30	25	35	25	167	165	+ 1.2	.06	.07
F. W. D.	11	25	13	10	138	83	+ 66.2	.05	.03
Reo	20	6	7	53	54	740	− 92.8	.02	.30
Miscellaneous	67	121	78	90	589	678	+ 3.0	.20	.28
Total	43,504	51,553	55,982	40,482	291,118	248,826	+ 17.0	100.00	100.00

mean "No. 1 heavy melting scrap."

According to the Commerce Department, the stringent embargo on aviation gasoline means a virtual end to the export business on this product since Europe took 1,076,238 barrels out of 1,164,343 exported by the United States during the first six months of 1940.

$8,000,000 Earmarked For Packard Motor Co.

Information given a Congressional committee on Aug. 8 by Federal Loan Administrator Jesse H. Jones is that around $8,000,000 has been earmarked for the Packard Motor Co., for expanding its facilities to manufacture Rolls Royce aircraft engines.

This amount will be made available, Mr. Jones said, out of a total of $150,000,000 to $200,000,000 for which the Reconstruction Finance Corp. has made "informal but definite commitments" for the construction of new airplane plants. The balance will be loaned to leading aircraft manufacturing companies.

Mr. Jones said that the commitments were made after conferences with William S. Knudsen, head of the production division of the National Defense Advisory Commission. Construction of six aircraft plants is expected to be made possible with $150,000,000 worth of loans.

Kettering Named Head Of Inventors Council

Dr. Charles F. Kettering, president of General Motors Research Corp., has been named chairman of a National Inventors Council whose job will be to encourage inventions by civilians and to appraise their usefulness from the standpoint of national defense. The council, to be set up under the Department of Commerce, has been directed to cooperate closely with the National Defense Research Committee headed by Dr. Vannevar Bush, president of the Carnegie Institution.

The judgment of the inventors council will be wholly advisory to the National Defense Research Committee and its parent organization, the National Defense Advisory Commission. It was explained that the establishment of the inventors council under the wing of the Commerce Department was prompted by the fact that the United States Patent Office, under the jurisdiction of the Department of Commerce, is now required by law to examine patent applications in order that it may withhold from publication inventions whose disclosure "might be detrimental to the public safety or defense." Under this law a determination of the military value of the disclosures is required. The task of the inventors council will be to perform a similar duty with respect to new ideas submitted in the form of a simple memorandum or rough blueprint instead of in the form required in patent applications.

"We Can Do The Job Mapped Out"—Knudsen

Head of Production Division of National Defense Advisory Commission Tells of Progress in Various Phases of Program

Satisfied after seven weeks as head of the industrial production division of the National Defense Advisory Commission that "we can do the job mapped out," William S. Knudsen in a recent press conference set forth these developments on various phases of the program:

Automobile industry's part in aircraft program—Aircraft orders are not being placed with automobile concerns because War Department plans, calling for conversion of plants for aircraft production, are based on war-time conditions. Until such conditions arise, the defense commission takes the view that expansion of existing aircraft facilities and the construction of new aircraft plants offer the preferred route rather than to disrupt peace-time schedules of automobile plants.

Negotiations for the construction of 9000 Rolls-Royce engines by Packard Motor Co. are still under way, but the question of amortization has not been a factor in delaying final settlement. Packard officials are conferring with representatives of the Reconstruction Finance Corp. (In what was described as the first substantial loan to industry under the defense program, the RFC approved a loan of $92,000,000 to the Wright Aeronautical Corp., for financing a new engine plant in Hamilton County, Ohio, designed to produce 12,000 aircraft engines a year.)

Aircraft and engines—Estimates on required capacities for planes and engines have been completed but are confidential. The industry is expected to be able to meet the goal of 25,000 complete aircraft, including engines and armor, by July 1, 1942, without any threatened interference with British orders. Existing aircraft production is 900 to 1000 planes per month with August production of 895 units divided roughly as follows: For the United States, 396; for Great Britain, 236; for other foreign countries including South American, 84; commercial planes for this country, 174; unclassified, 5.

Tanks—Months of effort will have to be expended on design alone, but tank designs are well advanced. Contracts already placed for the lighter type, include an initial order with American Car & Foundry Co. for 627. Heavier tanks are being re-designed in the light of European experience. Design of the light tanks requires 2400 individual drawings; for the 155 mm. gun carriage, 1000 separate drawings, an additional 500 for the re-coil mechanism; tank guns of 75 mm. 300 drawings, their panoramic sight, 160.

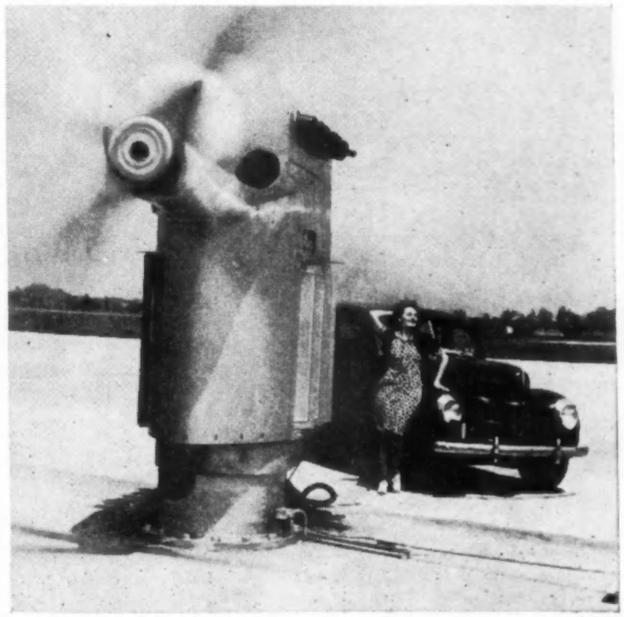
British aircraft purchasing program —The British Purchasing Commission has requested the defense commission to prepare cost estimates on a projected 3000-planes-a-month program. Tentative estimates showed that 38 plants, requiring from six to 11 months for construction, will be necessary and that the goal of 3000 planes monthly could not be reached until mid-1942. The defense commission will base its estimates on disclosed types of two and four-engine planes in both combat and training categories.

Light Ordnance and Explosives—

(*Turn to page* 183, *please*)

Cross-Wind

This huge cross-wind machine is installed on the Ford Motor Co.'s test track, Dearborn, Mich. Engineers use the device to study the effects on car stability under various conditions of wind intensity and direction. Maximum breeze supplied by the 14-ft. propeller is 50 m.p.h.



Acme

New Passenger Car Registrations

In the tables listed below are shown new passenger car registrations by makes and by retail price classes along with the estimated dollar volume of those retail sales. In addition to the usual monthly report of new registrations for the current month (June) we are again showing data for April and May of this year. Previous reports published in AUTOMOTIVE INDUSTRIES for these two months were incomplete as they did not include returns from the State of Oklahoma.

As the reports from this state are now available, it seemed advisable to furnish you with complete data on new car registrations by makes, by price classes and the estimated retail dollar volume of those sales.

	June	May	April	June	SIX MONTHS		Per Cent Change, 6 Months 1940 over 1939	Per Cent of Total Six Months		EIGHT MONTHS MODEL YEAR		
	1940	1940	1940	1939	1940	1939		1940	1939	1940	1939	Per Cent Change
Chevrolet	78,951	87,895	89,985	57,674	457,575	331,895	+ 37.8	25.22	23.55	581,914	435,879	+ 33.3
Ford	50,492	55,147	56,877	45,009	296,032	252,782	+ 17.1	16.31	17.94	387,322	319,368	+ 21.2
Plymouth	45,635	46,655	46,457	31,640	240,340	198,627	+ 21.0	13.25	14.10	268,987	265,919	+ 1.3
Buick	24,119	27,136	28,456	18,375	144,427	108,555	+ 33.0	7.96	7.70	195,875	146,386	+ 34.0
Pontiac	22,341	23,274	22,907	14,499	119,564	82,279	+ 45.4	6.59	5.84	155,813	108,019	+ 44.1
Dodge	19,413	21,251	21,827	18,154	113,027	108,719	+ 4.0	6.23	7.72	126,373	136,788	− 7.5
Oldsmobile	18,223	20,400	20,297	12,485	103,474	74,149	+ 39.7	5.70	5.26	137,051	99,552	+ 37.8
Chrysler	9,477	10,345	10,822	5,978	54,168	37,632	+ 44.0	2.98	2.67	60,046	48,429	+ 24.0
Studebaker	10,172	10,199	9,878	8,263	52,881	35,322	+ 49.5	2.91	2.51	70,044	44,790	+ 56.2
Mercury	7,405	8,117	8,754	6,139	44,457	32,308	+ 37.3	2.45	2.29	58,586	39,143	+ 49.6
Hudson	7,361	7,973	8,004	4,783	41,351	26,122	+ 58.2	2.28	1.85	57,693	35,529	+ 62.7
De Soto	6,910	7,032	7,303	5,204	37,806	28,458	+ 33.0	2.08	2.02	42,739	36,543	+ 17.0
Packard	6,352	6,978	7,228	4,504	37,448	24,435	+ 53.2	2.06	1.73	52,273	33,502	+ 56.0
Nash	4,719	5,196	5,924	4,704	29,051	28,834	+ 0.8	1.60	2.05	38,672	34,438	+ 12.5
La Salle	1,945	2,131	2,219	1,852	11,520	11,455	+ 0.8	.63	.81	16,722	16,059	+ 4.7
Willys	1,827	2,025	2,124	1,047	11,207	6,023	+ 86.0	.62	.43	15,131	7,945	+ 90.5
Lincoln	1,522	1,879	2,105	1,557	10,903	10,369	+ 5.2	.60	.74	14,929	13,731	+ 8.5
Cadillac	988	1,239	1,248	1,077	6,481	6,941	− 6.6	.36	.49	9,227	9,597	− 4.0
Graham	218	207	114	429	624	2,441	− 74.4	.03	.17	732	3,155	− 77.0
Bantam	57	81	103		512			.03		663		
Crosley	16	28	51		244			.01		351		
Hupmobile	12	3	2	115	33	670	− 95.0		.05	53	771	− 93.0
Fiat			2		11					20		
Miscellaneous	460	557	552	253	1,678	1,086	+ 54.5	.10	.08	1,713	1,385	+ 23.8
Total	318,615	345,748	353,239	243,741	1,814,814	1,409,102	+ 29.0	100.00	100.00	2,292,929	1,836,928	+ 25.0
Chrysler Corp.	81,435	85,283	86,409	60,976	445,341	373,436	+ 18.3	24.54	26.50	498,145	487,679	+ 2.0
Ford Motor Co.	59,419	65,143	67,736	52,705	351,392	295,459	+ 18.0	19.36	20.97	460,837	372,242	+ 23.8
General Motors Corp.	146,567	162,075	165,112	105,962	843,041	615,274	+ 37.0	46.45	43.66	1,096,602	815,492	+ 34.4
All Others	31,194	33,247	33,982	24,098	175,040	124,933	+ 40.2	9.65	8.87	237,345	161,515	+ 46.8

New Passenger Car Registrations and Estimated Dollar Volume by Retail Price Classes*

PRICE CLASS	NEW REGISTRATIONS								ESTIMATED DOLLAR VOLUME							
	April				Four Months				April				Four Months			
	Units		Per Cent of Total		Units		Per Cent of Total		Dollar Volume		Per Cent of Total		Dollar Volume		Per Cent of Total	
	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939
Chevrolet, Ford and Plymouth	193,319	148,267	54.81	55.27	629,172	494,946	54.72	55.98	$147,800,000	$108,400,000	48.48	47.77	$480,900,000	$362,000,000	48.36	48.29
Others under $1000	111,660	96,453	31.66	35.95	367,410	308,016	31.95	34.83	101,000,000	88,500,000	33.13	39.00	332,600,000	283,800,000	33.45	37.86
$1,001 to $1,500	45,269	19,510	12.84	7.27	144,737	68,492	12.60	7.75	51,200,000	22,700,000	16.79	10.01	163,900,000	80,100,000	16.48	10.68
$1,501 to $2,000	1,550	2,870	.44	1.07	5,265	8,283	.46	.94	2,700,000	4,400,000	.89	1.94	9,100,000	12,800,000	.92	1.71
$2,001 to $3,000	873	1,097	.25	.41	3,139	4,157	.27	.47	2,100,000	2,500,000	.69	1.10	7,600,000	9,500,000	.76	1.27
$3,001 and over	14	87		.03	56	303		.03	70,000	400,000	.02	.18	270,000	1,400,000	.03	.19
Total	352,685	268,284	100.00	100.00	1,149,779	884,197	100.00	100.00	$304,870,000	$226,900,000	100.00	100.00	$994,370,000	$749,600,000	100.00	100.00
Miscellaneous	554	51			672	330										
Total	353,239	268,335			1,150,451	884,527										

PRICE CLASS	NEW REGISTRATIONS								ESTIMATED DOLLAR VOLUME							
	May				Five Months				May				Five Months			
	Units		Per Cent of Total		Units		Per Cent of Total		Dollar Volume		Per Cent of Total		Dollar Volume		Per Cent of Total	
	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939
Chevrolet, Ford and Plymouth	189,697	154,035	54.95	54.86	818,869	648,981	54.77	55.70	$145,100,000	$112,700,000	48.69	47.42	$626,000,000	$474,700,000	48.44	48.09
Others under $1000	109,745	101,236	31.80	36.05	477,155	409,252	31.92	35.13	99,200,000	92,500,000	33.29	38.91	431,800,000	376,300,000	33.41	38.11
$1,001 to $1,500	43,401	21,062	12.58	7.50	188,138	89,554	12.58	7.69	49,000,000	24,300,000	16.44	10.22	212,900,000	104,400,000	16.47	10.57
$1,501 to $2,000	1,501	3,092	.43	1.10	6,766	11,375	.45	.98	2,600,000	4,800,000	.87	2.02	11,700,000	17,600,000	.91	1.78
$2,001 to $3,000	842	1,295	.24	.46	3,981	5,452	.28	.47	2,100,000	3,000,000	.70	1.26	9,700,000	12,500,000	.75	1.27
$3,001 and over	5	80		.03	61	383		.03	20,000	400,000	.01	.17	290,000	1,800,000	.02	.18
Total	345,191	280,800	100.00	100.00	1,494,970	1,164,997	100.00	100.00	$298,020,000	$237,700,000	100.00	100.00	$1,292,390,000	$987,300,000	100.00	100.00
Miscellaneous	557	34			1,229	364										
Total	345,748	280,834			1,496,199	1,165,361										

* All calculations are based on delivered price at factory of the five-passenger, four-door sedan in conjunction with actual new registrations of each model. The total dollar volumes are then consolidated by price classes.

Ourselves & Government

A Check List of Federal Action Corrected to Aug. 9

FEDERAL TRADE COMMISSION

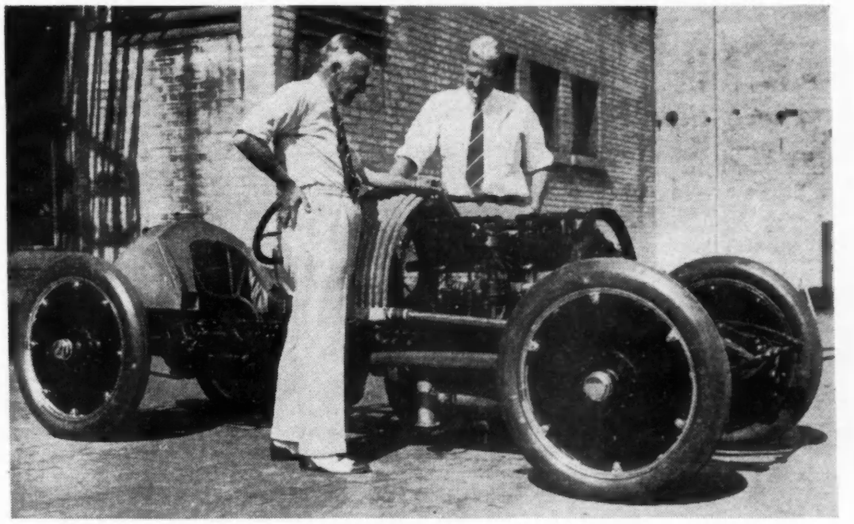
F.O.B. PRICE CASE—Both Ford and GM cases continue to be open for testimony, but no specific dates have been fixed for their continuance.

TRADE PRACTICE RULES—Despite the trade's opposition to the pending fair trade rules, FTC officials are represented as still proceeding, but decline to give any date when they expect promulgation.

GM EXCLUSIVE DEALER CASE—Commission brief in reply to respondent's brief was due Aug. 5, but it had not been filed at press time.

Charles H. Heller

Charles H. Heller, chairman of the board of the Bower Roller Bearing Co., died suddenly July 26 at his home in Detroit at the age of 65. He was one of the organizers of the company and its first secretary-treasurer, joining R. F. Bower in the incorporation of the company in 1907 at Dayton, Ohio. In 1924 Mr. Heller became president of the company, and in 1932 he assumed the chairmanship of the board, relinquishing the presidency to Silas A. Strickland.



The Buick Bug

A. E. DeWaters, left, former Buick chief engineer, and Charles A. Chayne, present chief engineer, shown with a reconditioned Buick Bug racing car which will be exhibited at the New York Automobile Show. The car was designed and built by Mr. DeWaters, Bob Burman and Louis Chevrolet in 1910. The four-cylinder engine has a bore and stroke of 6 in. by 5½ in., providing 623 cu. in. displacement. Power is transmitted through a torque tube drive to a rear axle having a gear ratio of 2¼ to 1. Mr. Chayne stated that the old engine was reconditioned to its original state with the exception "that we have added a starter, which had not been invented in 1910, and rigged a sirrocco type fan for cooling the tube and fin type radiator, in view of the fact that the car will be driven at idling speed." The Bug originally had no fan, relying on speed to force air to the cooling system

Institutional Truck Film Sponsored By AMA

Appointment of a motion picture concern to produce an institutional motor truck film has been announced by Robert F. Black, president, The White Motor Co., and chairman of the Motor Truck Committee, Automobile Manufacturers Association.

A special committee on Motor Truck Public Relations, headed by Dale Cox, public relations director, International Harvester Co., selected Wilding Pictures of Detroit to make the film after the presentations of several film producers of this type were reviewed.

Albert Kahn, Inc. Forms New Corporation

Albert Kahn, Inc., Detroit architects and engineers, announced recently formation of a new corporation to be known as Albert Kahn Associated Architects and Engineers, in which members of the organization will be stockholders.

MEN . . . . . .

Charles J. Marks has been appointed to the position of chief tool engineer of the United Aircraft Corp. Mr. Marks will assist the vice-president in charge of operations in coordinating the planning of facilities and tooling by the several divisions. The corporation also has announced the appointments of Arthur A. Merry and Frederick L.

(*Turn to page* 182, *please*)

New Passenger Car Registrations and Estimated Dollar Volume by Retail Price Classes*

PRICE CLASS	NEW REGISTRATIONS								ESTIMATED DOLLAR VOLUME							
	June				Six Months				June				Six Months			
	Units		Per Cent of Total		Units		Per Cent of Total		Dollar Volume		Per Cent of Total		Dollar Volume		Per Cent of Total	
	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939	1940	1939
Chevrolet, Ford and Plymouth	175,078	134,323	55.04	55.14	993,947	783,304	54.82	55.61	$133,900,000	$98,200,000	48.83	47.76	$759,900,000	$572,900,000	48.51	48.03
Others under $1000	101,344	88,728	31.85	36.42	578,499	497,980	31.91	35.35	91,500,000	81,000,000	33.37	39.41	523,300,000	457,300,000	33.40	38.33
$1,001 to $1,500	39,781	16,652	12.50	6.84	227,919	106,206	12.57	7.54	44,900,000	19,300,000	16.37	9.39	257,800,000	123,700,000	16.46	10.37
$1,501 to $2,000	1,210	2,657	.38	1.09	7,976	14,032	.44	1.00	2,100,000	4,100,000	.77	1.99	13,800,000	21,700,000	.88	1.82
$2,001 to $3,000	737	1,146	.23	.47	4,718	6,598	.26	.47	1,800,000	2,600,000	.66	1.26	11,500,000	15,100,000	.73	1.27
$3,001 and over	5	95	......	.04	66	478	......	.03	20,000	400,000	......	.19	310,000	2,200,000	.02	.18
Total	318,155	243,601	100.00	100.00	1,813,125	1,408,598	100.00	100.00	$274,220,000	$205,600,000	100.00	100.00	$1,566,610,000	$1,192,900,000	100.00	100.00
Miscellaneous	460	140	......	......	1,689	504	......	......	......	......	......	......	......	......	......	......
Total	318,615	243,741	......	......	1,814,814	1,409,102	......	......	......	......	......	......	......	......	......	......

* See footnote on facing page.

Business in Brief

***Written by the Guaranty Trust Co., New York, Exclusively for* AUTOMOTIVE INDUSTRIES**

General business activity has evidenced moderate acceleration recently. The index of *The Journal of Commerce*, without seasonal adjustment, for the week ended July 27 stands provisionally at 103.0 per cent of the 1927-29 average, as compared with 101.8 for the week before. The seasonally adjusted index of The New York *Times* for the week ended July 20 rose to 101.1 per cent of the estimated normal from 100.4 for the preceding week.

Retail trade has registered appreciable progress. Regional sales averages during the week ended July 27 ranged from six to 12 per cent above corresponding 1939 levels, according to Dun & Bradstreet estimates, as compared with gains ranging from four to 11 per cent in the preceding week. Department store sales during the week ended July 20, according to the Federal Reserve, were 9 per cent above the comparable 1939 total.

Production of electricity by the power and light industry during the week ended July 27 rose more than seasonally, and the excess above corresponding output last year advanced to 11.1 per cent from 10.0 per cent in the week before.

The number of railway freight cars loaded in the same period, 718,489, fell contra-seasonally 1.6 per cent below that for the preceding week but was 9.6 per cent above the comparable 1939 figure.

Bank debits to other than inter-bank accounts in leading cities during the week ended July 24 were moderately below the total in the week before; for the thirteen-week period then ended the aggregate was four per cent more than the corresponding amount last year.

Crude oil production during the week ended July 27 advanced moderately to an average of 3,690,400 barrels daily and was 62,000 barrels above the required output as computed by the Bureau of Mines, in contrast with a margin of 48,050 barrels below requirements in the preceding week.

Under the stimulus of defense preparations, engineering construction contracts awarded during the week ended Aug. 1 raised the cumulative 1940 total for the first time above the corresponding amount in 1939, according to *Engineering News-Record*.

Cotton-mill activity was unchanged in the fourth week of July, a period in which the usual trend is upward. The New York *Times* adjusted index, accordingly, declined to 137.9 from 142.0 for the week before, as against 132.1 a year ago.

Business failures during the week ended July 25 numbered 233, the smallest weekly figure in five months, according to the Dun & Bradstreet compilation, as compared with 288 in the preceding week and 291 in the corresponding period last year.

Professor Fisher's index of wholesale commodity prices for the same week declined further to 81.6 per cent of the 1926 average, the year's minimum so far, as against a maximum of 86.3 in the first week of the period.

Excess reserves of the member banks of the Federal Reserve system declined $370,000,000 during the fortnight ended July 31 from the all-time peak to an estimated total of $6,510,000,000. Business loans of the reporting members increased $15,000,000 in the two-week period ended July 24 to a total of $4,462,000,000, exceeding by $563,000,000 the comparable amount last year.

No Steel Price Concessions To Car Makers Anticipated

Advances In Prices Of Passenger Cars Interpreted As Clinching Firmness of Steel Price Structure

In the steel market recently announced advances in prices of passenger cars are interpreted as clinching the firmness of the steel price structure. On several occasions in the last few years the argument was advanced that an increase in steel prices would necessitate a mark-up in car prices and that this might affect car sales adversely to the detriment no less of steel producers than of automobile manufacturers.

If prevailing quotations for sheets and strip steel are made to apply to tonnage purchases for 1941 models, now overhanging the market, it means that automobile manufacturers will pay from $8 to $10 a ton more than they did for the bulk of their 1940 requirements. Flat rolled steel at prices somewhat lower than those now quoted is still being received by automobile manufacturers, consisting of tonnages due them on account of commitments made late in April.

At the rate, at which mills are receiving releases for this lower-priced steel, it will not be until after Labor Day when all shipments will have been made. Meanwhile, steel sellers look for a steadily rising volume of covering by automobile manufacturers to take care of their early autumn assemblies, and, considering the continuing high rate of steel demand from other sources, concessions are thought by many to be unlikely.

Automobile manufacturers continue to shape their steel purchasing programs with a view to having on hand, when initial 1941 assemblies get under way, sufficient parts and material to insure continuity of production in accordance with schedules. Some steel producers complain of too much hand-to-mouth buying by automobile manufacturers, but the character of most of the buying is preparatory rather than of the hand-to-mouth type.

It is unfortunate that, whenever buying by automobile manufacturers comes up for discussion, sheets and strip steel are the only descriptions considered. While it is true that these make up a large part of the steel consumption of automobile manufacturers, they are far from being the only shapes in which steel is consumed.

There has been consistent purchasing of steel bars, both carbon and alloy, in the last few weeks. Wire specialists report the demand for manufacturers' wire for automotive purposes as gratifyingly active recently. It is only natural that, being the largest consumers of sheets and strip steel, automobile manufacturers in the past have been given special consideration by steel producers, who must look for full employment of their continuous mills to no one more so than to automobile manufacturers. But these descriptions of flat rolled steels are by no means the only ones that are used in the manufacture of automobiles, and for all others automobile manufacturers have always paid current prices.

A misleading picture of conditions is being presented, when it is claimed that the purchasing agents of automobile manufacturers, as one financial writer charges, "have a talent or knack for beating down steel quotations in one form or another." Competition among steel producers has been responsible for price reductions much more often than has pressure exerted by automotive consumers. The volume of the steel consumption of automobile manufacturers, when it comes to shapes other than sheets and strip steel, is certainly a source of many hundreds of thousands of dollars worth of billings, regarding which the question of price is hardly raised. Operating rates of the steel mills during the week ended Aug. 10 were virtually unchanged, being at 90.5 per cent of ingot capacity, compared with 90.4 per cent in the preceding week.

The outstanding development in the market's non-ferrous metals division during the week ended Aug. 10 was the lowering of the price of aluminum by 1 cent a pound to 18 cents for 99 per cent plus virgin ingots in car lots. Copper is fractionally lower and tin easier.
—W.C.H.

AMA Group to Study Car Shipping Methods

Appointment of a committee of automotive engineers to study problems connected with the loading and transporting of finished cars and trucks has been announced by the Automobile Manufacturers Association.

The committee will give major consideration to 1942 products, minor changes already having been made in rail and highway transportation facil-

J. A. Hessler

. . . secretary and sales manager of the Western Felt Works, Chicago, who has announced formation by the company of the Acadia Synthetic Products Division for the manufacture of molded synthetic rubber products.

ities to accommodate the 1941 models.

Development of definite standards for freight cars and highway hauling equipment suitable for automobile loading will be an objective of the group, which will function as a sub-committee of the association's traffic committee.

F. A. Allen (Hudson) is chairman of the association's traffic committee. Members of the loading committee are Harry Golden (Buick), J. N. Prentis (Cadillac), R. R. Brown (Chevrolet), H. S. Wells (Chrysler), C. J. Bock (G.M.C. Truck), W. L. Norris (Hudson), R. F. Weber (International Harvester), E. D. McLean (Oldsmobile), E. A. Weiss (Packard), and J. W. Leggat (Pontiac).

Electric Auto-Lite Co. Gets $46,200 Contract

The Electric Auto-Lite Co., Moto-Meter Gauge and Equipment division at LaCrosse, Wis., has been awarded a $46,200 contract for aircraft engine gage units.

Morris Eckley Mutchler

Morris Eckley Mutchler, general sales manager of the Sterling Engine Co. of Buffalo since 1920, died suddenly at his home in Kenmore, N. Y., July 22. In recognition of his achievement in the marine engine field, he recently was awarded a medal given annually to the man who has done the most to help advance the industry.

Ford and Aviation Industry Are Major 1941 Goals of UAW-CIO

Roy J. Thomas Re-Elected President By Acclamation At Fifth Annual Convention of Union in St. Louis

Organization of Ford Motor Co. employes and of the rapidly expanding aviation industry were cited as the major objectives of the UAW-CIO for the coming year by President Roy J. Thomas when he addressed the fifth annual convention of the union held, July 29 to Aug. 5, in St. Louis.

"We've had a tough struggle with Ford but are more determined than ever to go on," Thomas asserted in addressing the convention.

To further the Ford drive as well as the organization of the aircraft industry, the convention voted for a national referendum of the union's 382,000 members on a proposed assessment of $1 per member. The vote is to be completed by Oct. 1 and the assessment would be payable by Dec. 31 if approved.

The special levy is expected to raise $200,000, if approved. Last year a special assessment produced $64,962, while a Ford assessment brought in $23,593. The union spent only $7,080 on the Ford organization drive last year, according to the annual report of George F. Addes, secretary-treasurer. This compared with $17,662 spent organizing the WPA, $14,957 on the aircraft industry, $30,716 on the General Motors organization and $16,235 on Chrysler.

The rapid growth of the UAW-CIO in the last year was illustrated by Thomas's report that dues-paying members numbered 294,428 in May, a gain of 93 per cent over the previous year, when there were 152,385 members on the rolls. Thomas reported 647 plants under contract compared to 321 plants in 1939 and 501 in 1938.

In the factional split with the AFL, the UAW-CIO won NLRB elections and bargaining rights in 110 plants compared to 14 for the UAW-AFL and 13 for AFL craft unions. More than 400,000 workers are covered by UAW-CIO bargaining agreements, Thomas stated.

For the 12 months ending April 30, total income of the UAW-CIO was $1,064,312, according to Addes' report. Expenditures over the same period were $968,141. On June 30 the cash balance was $107,139. The convention voted to increase the international union's share of the $1 monthly dues from 37½ to 40 cents. This will be used to press the organization drives against Ford and the aircraft plants and also small parts companies and farm equipment manufacturers.

Thomas predicted that the union will seek vacation-pay allowances, similar to those granted in the recent GM contract, when the contract is renewed with Chrysler Corp. next November. Last fall demands for pay increases precipitated a 54-day strike in the Chrysler plants.

Effect of the dual union factionalism upon the UAW-CIO was revealed in membership figures for June, 1939, which showed only 10,800 members in GM plants. This compares with 130,000 GM workers who now are covered by exclusive UAW-CIO contracts in 60 plants. Only 8 per cent of the GM workers were organized by the UAW-CIO in June, 1939, while 4 per cent belonged to the UAW-AFL at that time. NLRB elections are now pending in eight additional GM plants with 20,000 workers, while organizational drives are now in progress in nine other GM plants employing 25,000.

Sidney Hillman, CIO vice-president and member of the National Defense Council, paid tribute to William S. Knudsen, president of the GM who is on leave to head the Defense Council. Addressing the convention, Hillman said:

"I haven't had a single request from Knudsen to do anything we are opposed to doing, and I'm getting much better acquainted with him than in the troublesome days of the automobile strikes."

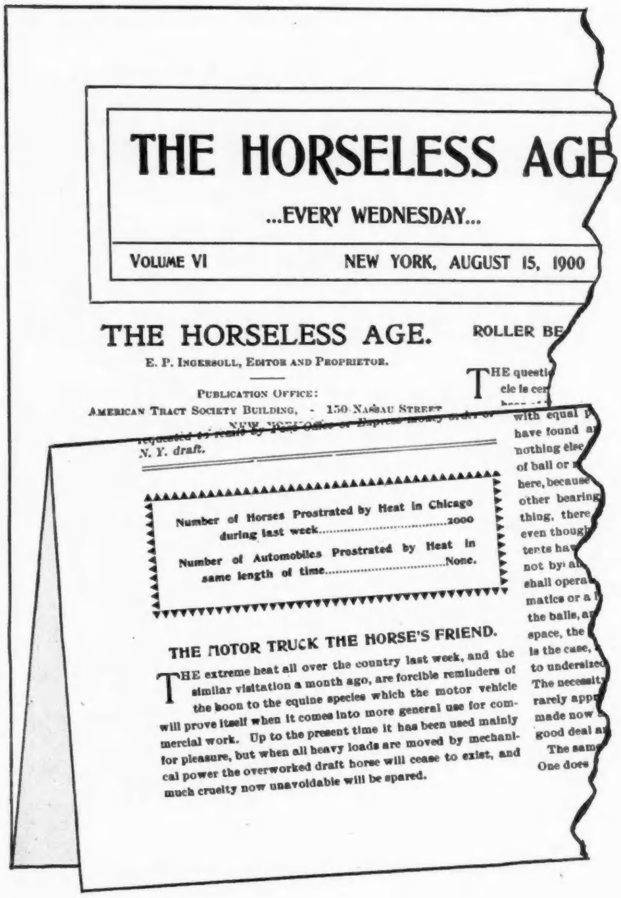
Signing of a contract between the

(*Turn to page* 183, *please*)

Gun Truck

One of the new four - wheel drive artillery gun trucks being manufactured in the Canadian Ford company plant at Windsor, Ont. It is powered by a 100 hp. engine.

Acme


THE HORSELESS AGE

...EVERY WEDNESDAY...

VOLUME VI NEW YORK, AUGUST 15, 1900

THE HORSELESS AGE.

E. P. INGERSOLL, EDITOR AND PROPRIETOR.

PUBLICATION OFFICE:
AMERICAN TRACT SOCIETY BUILDING, - 150 NASSAU STREET

N. Y. draft.

Number of Horses Prostrated by Heat in Chicago during last week..........2000

Number of Automobiles Prostrated by Heat in same length of time..........None.

THE MOTOR TRUCK THE HORSE'S FRIEND.

THE extreme heat all over the country last week, and the similar visitation a month ago, are forcible reminders of the boon to the equine species which the motor vehicle will prove itself when it comes into more general use for commercial work. Up to the present time it has been used mainly for pleasure, but when all heavy loads are moved by mechanical power the overworked draft horse will cease to exist, and much cruelty now unavoidable will be spared.

40 Years Ago

AUTOMOTIVE INDUSTRIES has reprinted for many years brief items from the pages of issues of its predecessor the *Horseless Age*, published 40 years ago. Never has one of these items seemed quite so timely as the editorial reproduced herewith, "The Motor Truck The Horse's Friend" which appeared in the Aug. 15, 1900 issue. We especially like the little box in which the number of horses prostrated by the blistering Chicago heat is compared with the number of motor vehicles that succumbed to the high temperatures.

Men

(*Continued from page* 179)

Woodcock to the positions of chief tool engineer of Pratt & Whitney Aircraft Division and Hamilton Standard Propellers Division, respectively. Messrs. Merry and Woodcock will have charge of the tool engineering departments of these respective divisions.

F. C. Kroeger, manager General Motors Anderson Delco-Remy division for 11 years, has been made manager of Allison Engineering at Indianapolis, and **Otto T. Kreusser**, plant manager for three years, is now in charge of mechanic training and experimental activities at Allison.

S. C. Merrill has been named assistant general sales manager of the Automotive division of the Timken Roller Bearing Co.

M. J. Tennes, Jr., has been elected president of Shafer Bearing Corp., Chicago. For the same company, **A. H. Williams** has been elected vice-president, and **Ray P. Tennes**, secretary and treasurer.

Charles H. Chatfield has been named executive assistant to the vice-president, and **Frank W. Caldwell** director of research for the United Aircraft Corp. In his new capacity, Mr. Chatfield will be charged with the administrative functions of the general offices. Mr. Caldwell will be in charge of the research division of the corporation and will function also as a general adviser to the management on engineering matters. **Erle Martin** has been appointed engineering manager of the Hamilton Standard Propellers division, succeeding Mr. Caldwell. At the Vought-Sikorsky Aircraft division in Stratford, **Joseph M. Barr** has been made factory manager, and **James J. Gaffney** assistant treasurer and division accountant, succeeding **E. H. Glaettli** who has been assigned other duties and will continue as an assistant secretary. **William R. Robbins**, now assistant general accountant of United Aircraft Corp., will succeed Mr. Gaffney as assistant treasurer and assistant secretary of the Pratt & Whitney Aircraft division.

O. E. Hunt, vice-president and member of the administration committee of General Motors Corp., has been elected a member of the policy committee, with specially-assigned duties. **H. H. Curtice**, vice-president of the corporation and general manager of the Buick Motor division of General Motors, has been made a director to succeed Seward Prosser, recently resigned. **C. L. McCuen**, general manager of the Olds Motor Works division of General Motors, is now a vice-president of the corporation and has been transferred to the central office, in charge of engineering activities. In addition, the following organization changes are being made: **S. E. Skinner**, general manager of Ternstedt Mfg. division, to become general manager of Olds Motor Works division. **J. W. Jackson**, works manager of Ternstedt Mfg. division, to become general manager of Ternstedt Mfg. division. **F. C. Kroeger**, general manager of Delco-Remy division, to become general manager of Allison division. **O. V. Badgley**, factory manager of Delco-Remy division, to become general manager of Delco-Remy division.

John P. Moran has been elected to the presidency of the Gemmer Mfg. Co., Detroit, succeeding the late Edward P. Hammond. Mr. Moran has been with the company since 1910, serving as vice-president in charge of production since 1925.

CALENDAR

Conventions and Meetings

SAE West Coast Transp. & Maintenance Meeting, Seattle ....Aug. 16-17
National Industrial Advertisers Association, Annual Meeting, Detroit, Sept. 18-20
SAE National Tractor Meeting, Milwaukee ....Sept. 24-25
SAE Annual Dinner, New York......Oct. 14
American Society for Metals, Annual Meeting, Cleveland, Ohio....Oct. 21-25
American Welding Society, Annual Meeting, Cleveland ....Oct. 20-25
SAE Nat'l Aircraft Production Meeting, Los Angeles ....Oct. 31-Nov. 2
Aeronautical Chamber of Commerce of America, Inc., Annual Meeting, New York ....Dec. 5
National Association of Manufacturers, Annual Meeting, New York...Dec. 9-13
SAE Annual Meeting, Detroit, Jan. 6-10, 1941
National Automobile Dealers Association, Convention, Pittsburgh, Pa. Jan. 20-23, 1941

Shows at Home and Abroad

National Automobile Show, Grand Central Palace, New York........Oct. 12-19
Detroit Automobile Show........Oct. 12-19
Pittsburgh Automobile Show.....Oct. 19-26
National Metal Congress & Exposition, Cleveland, O. ....Oct. 21-25
Chicago Automobile Show....Oct. 26-Nov. 3
Automotive Service Industries Show, Chicago ....Dec. 9-14
Machine & Tool Progress Exhibition, Detroit ....Mar. 24-29, 1941

Machine Tools

(*Continued from page* 175)

(1) portable tools driven by fractional horsepower motors or by compressed air; (2) brakes, rolls, shears, small punches, if hand operated; (3) repair parts for machine tools, other than important sub-assemblies, in quantities not sufficient to constitute a substantially complete metal working machine; and (4) small tools, such as cutters, drills, taps, and grinding wheels.

It was recalled that the original proclamation was interpreted as subjecting virtually all machine tools to the export restriction by specifically bringing under the export control metal working machinery for (1) melting or casting; (2) pressing into forms; (3) cutting or grinding, power driven; and (4) welding machines.

PUBLICATIONS

The Electric Controller & Mfg. Co., Cleveland, Ohio, has released a broadside covering its line of **brakes** for cranes, hoists and mill machinery.*

Flexrock Co., Philadelphia, Pa., has issued a new pamphlet describing its "Rugged-wear" **floor resurfacing material** which now is processed with "Chrysotile" to provide greater toughness.*

A pocket booklet entitled "Steel Lockers, Cabinets, Shelving" gives detailed specifications and prices of heavy gage **steel lockers, cabinets and shelving** built by the Penn Metal Corp. of Penna., Philadelphia, Pa.*

Lift jacks and lift jack platform trucks are illustrated and described in the first section of a new loose leaf catalog issued by the All Steel Welded Truck Corp., Rockford, Ill.*

J-B-T Instruments, Inc., New Haven, Conn., has brought out a descriptive pamphlet covering its new portable **potentiometer-pyrometer.***

"How To Determine Where Overhead Materials Handling Equipment Can Be Used Profitably" is the title of a booklet prepared by the Cleveland Tramrail division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.*

Electrical Testing Laboratories, New York City, has published a pamphlet entitled **"Independent Laboratory Services to Government"** with the idea of calling the Government's attention to the commercial laboratories throughout the country as an adjunct in preparation for defense.*

*Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

Car Building Program For Australia Stymied by War

The plans of Australian Consolidated Industries, Ltd. to manufacture motor vehicles in Australia have been deferred, probably until the present war is ended, according to a report made to the Department of Commerce through the American consulate general in Sydney, Australia.

Knudsen

(Continued from page 177)

Under contracts signed with the du Pont company, a government-owned powder plant at Charlestown, Ind., having a production capacity of 200,000 lb. per day, will be erected at Charlestown, Ind.

UAW-CIO

(Continued from page 181)

General Motors Corp. and the UAW-AFL on July 15 has been belatedly revealed. The contract covering five GM plants in Kansas City, Norwood, Ohio, and Meriden, Conn., grants the same wage increase ratios and vacation allowances granted to the UAW-CIO in the contract signed June 24.

The UAW-CIO agreement permits either the corporation or union to appeal certain types of disputes under the contract to a paid umpire, but the AFL agreement retains an earlier clause for an umpire's ruling only where both sides agree to the appeal. The UAW-AFL contract covers 6000 GM workers. It was signed by F. O. Tanner, vice-president in charge of labor relations, for GM, and by Irvan Carey, president, and Jerry Aldred, secretary-treasurer, for the AFL.

Election of officers and directors concluded the convention program with a purge of five members of the union's powerful executive board who were named a year ago with the support of Communist sympathizers. The five directors were the only ones not reelected.

R. J. Thomas, president and George F. Addes, secretary-treasurer, both of Detroit, were reelected by acclamation.

New directors named were: Linwood Smith, Saginaw; Carl Swanson, Flint; Jack Thompson, Toledo; Arnold Atwood, New Castle, Ind.; George Nordstrom, Kenosha, Wis.; Peter J. Zanghi, Buffalo.

Directors reelected were: Richard T. Frankensteen, Walter P. Reuther, Richard T. Leonard, and Leo Lamotte, all of Detroit; William McAulay, Pontiac; Delmond Garst, St. Paul; Richard E. Reisinger and Paul Miley, Cleveland; Lawrence Smith, Atlanta; George Burt, Windsor, Ont.; L. H. Michener, Los Angeles.

Men and Machines

(*Continued from page 171*)

model bodies in automobile plants.

The machine illustrated makes 36 spots to join the two halves of two sizes of automobile hood tops. In operation, each hood top half is loaded into the machine—from front and back, respectively. The operator then touches the control button to raise the work to welding position. This is accomplished through four air cylinders. At the end of their stroke an automatic valve is tripped and additional cylinders superimpose a "wedging" support for the central portion of the work table. The machine thus automatically begins its welding cycle. When completed, the table returns to open position and the work is unloaded through one end of the machine.

A built-in timing mechanism makes possible very rapid distribution (timing) of current so that only one transformer is required. A ¼-hp. air motor drives an indexing disk which has a single port near its edge. Synchronized with the operation of this disk—by means of gears—are two automotive-type distributors. When the port in the disk comes into alinement with a similar port in the timing chamber, it permits a charge of air—under pressure—to close one of the contact guns. This gun closes the secondary connection between transformer and work.

Welding current flows through one gun, through the lower electrode up via another gun. Thus, two welds are made at one time, in series. All 36 welds are make during one complete revolution of the timing disk. Following the last weld, the machine automatically returns the table to normal loading position.

Secondary current transfer is by means of a unique type of air-operated contact gun. This gun consists of a cylinder with two split section pistons, the upper piston being cut diagonally. When air from the timing port enters this chamber it forces the piston down, to establish contact with a bus bar (from transformer) and also forces the piston to one side (due to the diagonal top) so that it makes a positive contact with the side of the cylinder. The latter is connected with its respective welding point. Connection is broken by a return spring which acts immediately when pressure is relieved.

Close control of welding point pressure is possible through the method of mounting each electrode. All welding points can be adjusted to a pre-determined pressure by means of high pressure spring. A calibrated scale on each welding gun permits direct reading of pressure. Height adjustment for each welding tip is provided in the manner of mounting it in its individual mounting block.

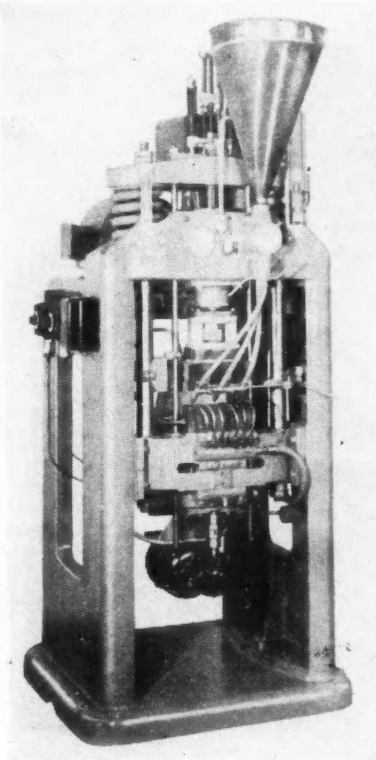
The Taylor Sales Co., Milwaukee, Wis., is offering a new series of "Hi-Eff" drilling machines which it calls series B. These units are furnished with chuck capacities of ¼ in., 5/16 in., ⅜ in., ½ in. and ⅝ in., and are designated as models B-200, B-202, B-204, B-206 and B-208, respectively.

The principal dimensions of the machine are as follows: drilling range from column to center of table, 10 in.; vertical distance from end of chuck to face of table, 18¼ in.; travel of spindle, 4½ in.; diameter of column, 2¾ in.; minimum spindle diameter, ¾ in.; maximum spindle run-out, 0.001 in.; height (overall)—bench type, 46½ in.; bench or floor space, 16 in. by 32 in.; travel of drill head, 16 in.; working surface dimension of base table, 13 in. by 14 in.; working surface dimension of round table, 10 in. diam.; height (over-all)—floor type, spindle up, not over 7 ft. The bench type machine weighs approximately 225 lb., the floor type, 270 lb.

The table is adjustable vertically on

the column and can be locked by means of a clamp arrangement. It also is adjustable horizontally to a full 360 deg. and can be tilted 90 deg. from a horizontal position. The drill head is adjustable for vertical traverse on the column and can be clamped quickly and securely to the column at any position. The feed mechanism consists of a steel gear rack and pinion manually operated by means of a balanced handwheel. It is provided with a graduated depth gage to set the depth of cut. Drill chucks are of Jacobs manufacture, key type, three-jaw, with the taper of the chuck fit to the drilling machine spindle. An interchangeable socket can be supplied to interchange with the spindle and a No. 2 Morse taper.

The machine can be supplied with



One of the new Type 1 Acme "Hot Spot" welders

six spindle speeds: 750, 1000, 1500, 2000, 2700, and 4000 r.p.m., or 1500, 2000, 3000, 4000, 5400 and 8000 r.p.m.

THE Mall Tool Co., Chicago, is manufacturing an improved hanger bail type flexible shaft grinder for production work in automobile body and other industrial operations. These grinders can be mounted on trolleys for moving from one place to another in the plant or they can be fixed in a stationary position near a conveyor. They are furnished with ¾ hp. or 1 hp. dust and vapor proof type motors, totally inclosed switches, and various lengths of flexible shafting to suit individual requirements. Motors are capable of delivering 100 per cent additional power on momentary overload. Angle and straight spindles are equipped with extra large ball bearings.

The grinders are operated directly from the regular electric current supply. Total weight in the operator's hand is about seven or eight pounds. One feature is that the operator can drop the spindle with the sanding or polishing attachment after using it without damage because the tool will not strike the concrete or hard surface floors. It will hang within a few inches of the floor until the operator is ready to do more grinding or polishing work.

This company also builds a flexible shaft grinder designed for removing excess metal after welding, wire brushing, polishing and disk sanding. It is driven by a ¾-hp. motor mounted on a tilting swiveling caster base mounting with a tool tray. The revolving flexible shaft is 7/16 in. in diameter and 6 ft. in length.

ADDITIONAL announcements of new product developments submitted to **Men & Machines** are as follows:

The Dumore Co., Racine, Wis.—Improved types of AA and A3A motors with self-aligning bearings instead of the fixed type sleeve bearings replace the A and A3 motors in this company's line of fractional horsepower universal motors.

Cullen-Friestedt Co., Chicago.—The C-F line of welding stands has been augmented by a new size, Model 12 Positioner, capacity 1200 lb. It can be tilted a total of 135 deg. from horizontal and the table can be revolved through a full 360 deg. regardless of angle of tilt. The table is removable for attachment of special jigs and fixtures and is adjustable in height.

Jackson Electrode Holder Co., Detroit.—Two new, ruggedly constructed sweat bands, made of fine pore, cellulose sponge stitched to a fabricoid band with an inner lining of cork. No. 15 is a general purpose band to eliminate the hazard of perspiration running into the eyes. The No. 5 model is intended for use with all Jackson eyeshields except Types D, D-6 and No. 25.

Dual Remote Control Co., Wayne, Mich.—A new electric soldering tool known as the Ducon "Solder Master." A push button controls the flow of solder from a fountain head attached to the tip end of the iron, allowing the operator a free hand to hold or adjust parts.

Ozalid Corp., Johnson City, N. Y.—Fast-printing Whiteprint machine known as the Model "F". Printer and dry-developer are combined in one compact, lightweight unit which can be installed in any print room, drafting room, plant or office. A high pressure mercury vapor lamp with an output of 40 watts per inch and an active length of 46 in. gives printing speeds ranging up to 56 in. per min. with uniform light distribution over the printing surface.—H.E.B., Jr.

Publications Available

"The Use of Abrasives for Removing and Finishing Metals" is the title of a folder, No. G-455, issued by Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati. The same company also has issued a six-color booklet entitled **"Better Grinding in Your Toolroom."***

Sheet handling equipment built by Cullen-Friestedt Co., Chicago, is the subject of bulletin SL-18 issued by this company.*

An **electric marker** designed for marking tools, parts and materials permanently is the subject of a leaflet published by the manufacturer, the Ideal Commutator Dresser Co., Sycamore, Ill.*

Industrial power tools built by the Delta Mfg. Co., Milwaukee, Wis., are described in a new catalog.*

"Radio Principle" **controllers** built by Wheelco Instruments Co., Chicago, are described in a new leaflet.*

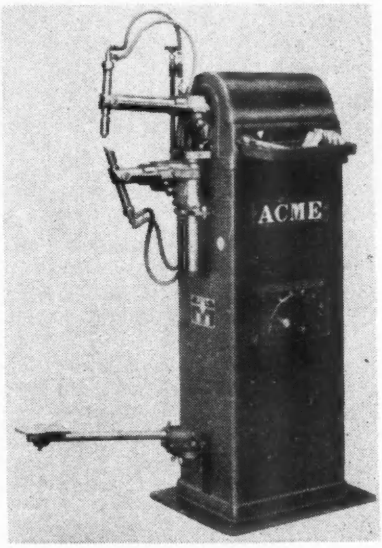
Circular No. 52 issued by the American Foundry Equipment Co., Mishawaka, Ind., describes the firms new **wet disposal unit for dry type dust collectors.***

Newest folder published by Continental Machines, Inc., Minneapolis, Minn., is entitled **"Eight Different Jobs Show Doall Advantages Over Eight Basic Cutting Methods."***

Catalog sheet No. 510 prepared by Electric Soldering Iron Co., Inc., Deep River, Conn., describes this company's **spot soldering machine.***

Hobart Brothers Co., Troy, Ohio, has published a bulletin which describes its "Streamliner" junior gas engine driven **arc welder.***

Welding Briefs, an interesting house organ published by the Metal & Thermit Corp., New York, N. Y., is devoted to reporting details of industrial applications for electric arc welding.*



An automatic "Unscrewing Device" now built into the Stokes automatic molding press makes possible the production of t h r e a d e d plastic moldings at rates of up to 1000 per mold-cavity per day

A 40-page catalog, No. N-33A (6), has been published by the Leeds & Northrup Co. Philadelphia, Pa. It lists the complete line of **thermocouples,** assemblies, parts and accessories supplied by the company.*

Stephens-Adamson Mfg. Co., Aurora, Ill., has brought out a new Redler **conveyor-elevator** catalog. It is designated as No. 140.*

A pocket-size pamphlet covering the Murex line of **electrodes** for arc welding has been published by the Metal & Thermit Corp., New York.

*Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

Automotive Materials

(*Continued from page* 162)

permeability is a new development being offered by the Jessop Steel Co., Washington, Pa. The steel has a magnetic permeability of 1.003 to 1.006 at 1000 Oersteds magnetizing force at temperatures from sub-zero to boiling. It also has the high electrical resistance of 69 to 71 microhms per centimeter.

In the annealed condition this steel has a tensile strength of 80,000 to 110,-000 lb. per sq. in.; yield point, 35,000 to 60,000 lb.; elongation in two inches, 25 to 50 per cent; reduction of area, 30 to 60 per cent; Izod impact value (at room temperature), 80 ft.-lb. It can be formed, welded, machined or blanked.

The manufacturer calls its new product Jessop Non-Magnetic Steel.

Improvements In 18/8 Stainless Steel Obtained by Adding Silver

Research carried out at Massachusetts Institute of Technology indicates that when silver is added to the 18/8 type of chromium-nickel (stainless) steel in proportions ranging between 0.1 and 0.3 per cent, the tendency of the material to become pitted by the corrosive action of ferric and other chlorides and by sea water is counteracted. Chlorides of iron, nickel and chromium are soluble, whereas the silver, which is homogeneously dispersed throughout the mass of the material, forms an insoluble chloride and this fact, it is claimed, greatly enhances the resistance of the steel to pitting corrosion Further, the silver-bearing 18/8 steel is more easily machinable, and undergoes a lower degree of work-hardening than that containing no silver. In support of this, it is stated that, under conditions which would permit of turning ordinary 18/8 steel with a cutting speed of 70 ft. per min., a silver-containing steel will allow a cutting speed of approximately 100 ft. per min. to be employed without tool failure. It is, moreover, claimed that the silver-bearing steel has a higher thermal conductivity than the ordinary alloy, and that the capacity for taking a high polish is further increased. Owing to the tendency of silver to volatilize at the melting temperatures employed in the manufacture of these high-alloy steels, however, the silver must be introduced into the material in the form of a master alloy of nickel and silver.

The tensile strength and ductility of castings of the new steels appear to be very similar to those of the straight nickel-chromium alloy steel, but the silver-containing steel is said to possess improved forging qualities.

According to a paper read before the Electrochemical Society by G. F. Landgraf, improvement in the resistance of stainless steel to pitting corrosion in sea water and other chloride solutions has also been effected by the addition of molybdenum, but the use of this type of steel is limited by difficulties in fabrication. It appears that molybdenum when added in the proportion of about 3 per cent, increases the ultimate strength and reduces the proportional elongation of the alloy.

G. E. Publishes Data on Flamenol

Flamenol, a synthetic compound resembling rubber that serves both as an insulation and a finish for wire and cable, is the subject of a new leaflet published by the General Electric Co., Schenectady, N. Y. Among the many advantages set forth for Flamenol are its high dielectric strength, toughness, strength and the fact that the cable requires no protective braid, lead, or armor except where mechanical abuse is extremely severe. Flamenol suffers no loss in properties when exposed to sunlight and oxygen. It is very stable when subjected to ozone and chemicals of an oxidizing nature. Oils, solvents, acids or alkalies will not attack the material. Another important property is that of flame-resistance. Other desir-

able characteristics of Flamenol brought out in the descriptive leaflet, designated as GEA-2733D, are high resistance to moisture, smooth finish and availability in a wide variety of colors.

Hard Facing Alloys and Overlay Metals

Wall-Colmonoy Corp., Detroit, producers of corrosion and abrasion resistant alloys, has issued several new pieces of literature covering its various Colmonoy products. Bulletin No. 73 described Colmonoy No. 9 as a rod that can be used with good results for tipping nearly all kinds of edged tools. No. 9 can be welded on annealed air-hardening steel for use on hot or cold forming dies. It also can be cast easily and in such form is recommended for small or intricate parts where overlaying is impracticable.

As applied with oxy-acetylene flame or as cast, and without resorting to heat treatment, the hardness of Colmony No. 9 is given as Rockwell 65-68 (C Scale) or 84-86 (A Scale). Its red hardness also is high, making it suitable for application to tools and dies which must retain sufficient hardness at elevated temperatures to maintain a cutting edge. The melting point is sufficiently low to permit application of the material to various tools without danger of coarsening the adjacent grain structure. Inasmuch as Colmonoy No. 9 is an iron-base alloy, its use in places where much corrosion is encountered is not encouraged.

Other Colmony alloys, their properties and applications, are discussed in general catalog No. 72.

Standardization Tests for Rubber Products

In the report of Committee D-11 on Rubber Products, presented at the annual meeting of the American Society for Testing Materials, held at Atlantic City, N. J., June 24 to 28, there was brief reference to three new standards approved by the Society late last fall, covering methods of testing sponge rubber and hard-rubber products and tests for viscosity and total-solids content of rubber cements. These tentative standards are said to represent the first attempts at quality control of the materials involved.

Two of the new test methods approved were developed by D-11's Technical Committee A on Automotive Rubber, which is sponsored jointly by the S.A.E. and A.S.T.M. One covers testing of automotive hydraulic brake hose, the other is a test for compression-deflection characteristics of vulcanized rubber. The specifications for brake hose have been referred to the S.A.E. for inclusion in its standards. These standard requirements and testing procedures are said to meet urgent demands from automotive engineers and state highway departments for suitable requirements for the control of hydraulic brake hose used on licensed vehicles on the highways. Testing requirements for hydraulic brake hose cover volumetric expansion under pressure, bursting strength, fatigue life, and tensile strength. The test procedures for determining the compression-deflection characteristics of vulcanized-rubber compounds involve two procedures: in one the load required to cause a specified deflection is determined, while in the other the specified weight or compressive force is applied to the specimen and the resulting deflection is measured and recorded.

Two other new tentative standards cover tests for accelerated aging of vulcanized rubber by the oxygen-pressure method at 80 C and specifications for insulated wire and cable: ozone-resistant insulation. Five tentative standards are to be referred to the Society ballot for adoption as standard.

Lewis Larrick, Physical Research Laboratory, The B. F. Goodrich Co., discussed the standardization of durometers in a technical paper. He referred to a number of instruments in use and to some of the problems involved, including that due to lack of agreement among the different instruments and even among instruments of the same type. Standardization of a program on one of the durometers which has been in use for several years was discussed.